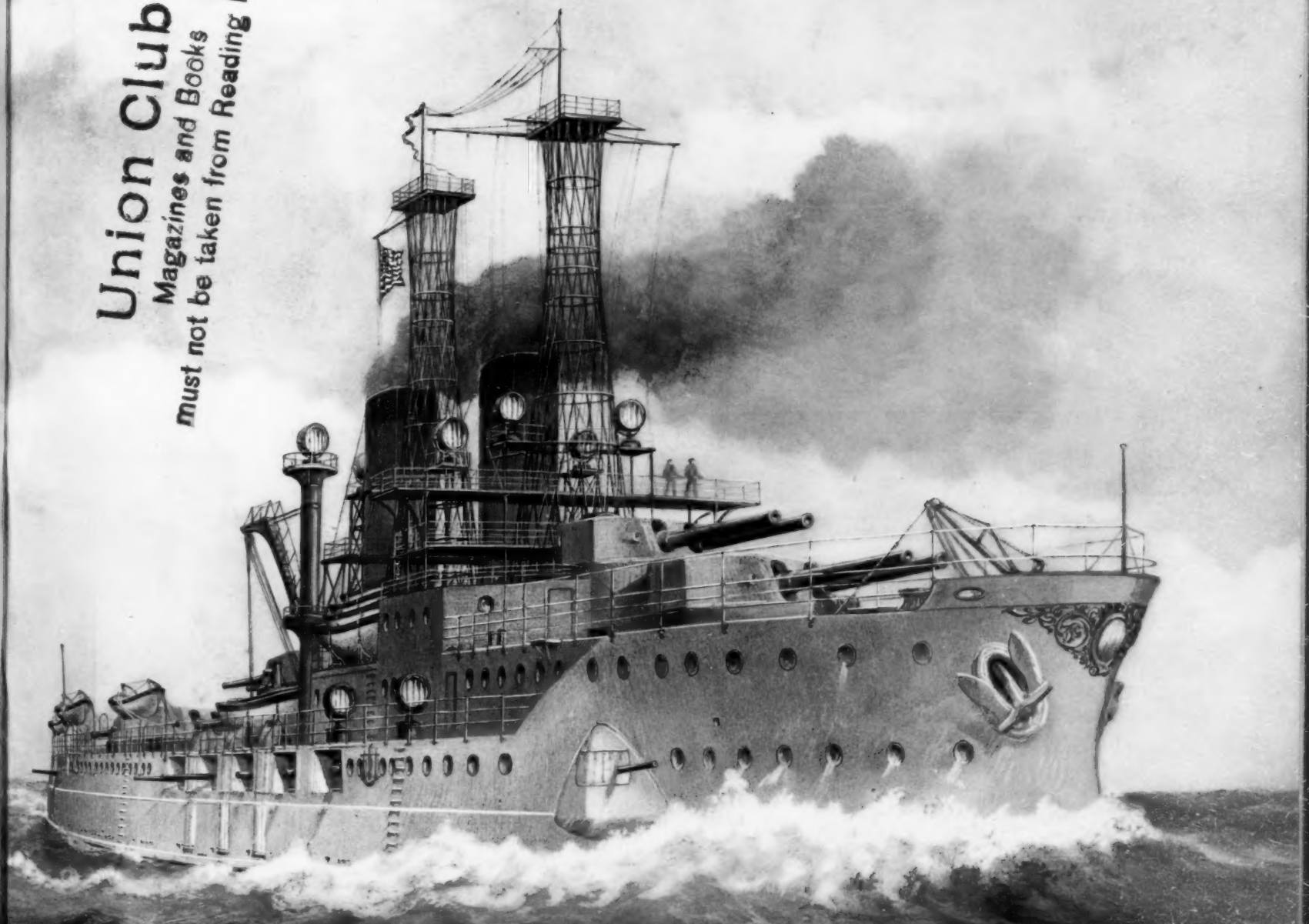
E 20

UNION CLUB FEB 19 1909

Union Club
Magazines and Books
must not be taken from Reading Rooms

SCIENTIFIC AMERICAN



NAVY SPECIAL

THE 42,000 MILE CRUISE

C.M. Knight-Smith

SCIENTIFIC AMERICAN.

FEBRUARY 20 1909
VOL. C.- No. 8

PUBLISHED BY
MUNN AND COMPANY
NEW YORK

PRICE TEN CENTS

W. & L. E. GURLEY
TROY, N.Y.

PRECISION INSTRUMENTS for

Civil, Mining and Hydraulic Engineers and Land Surveyors - - - Catalogue G

Physical Laboratories, Schools and Colleges and Scientific Research - Catalogue P

U. S. Standard Weights and Measures - Catalogue S

Accurate Mercurial Thermometers - - Catalogue W

Catalogues and full information furnished on request

BRANCH FACTORY
Manufacturers' Exchange Building
SEATTLE, WASHINGTON

The
New Models 10 and 11

Remington

do more than supply every demand; they *anticipate* every demand of every user of the writing machine.

SOME OF THE NEW FEATURES

New Single Dog Escapement
New Column Selector (Model 10)
New Built-in Decimal Tabulator (Model 11)
New Two-Color Dial
New Back Space Key
New Variable Line Spacing Lock
New Shift Lock
New Paper Feed

Remington Typewriter Company
(Incorporated)
New York and Everywhere

Let Us Help You To

Be A Manufacturer And Factory Owner

YOU CAN OWN A FACTORY LIKE THIS

Under Our New Plan
We Give You
Tools And Equipment
FREE

We Will Start You in the Canvas Glove Business and give you without cost the necessary tools, simply with the understanding that you buy supplies and material from us so long as our prices are as low or lower than you can get elsewhere.

Immense Profits are made in this fascinating business. The McCreery Brothers started only a few years ago without a cent. They actually borrowed $100 to start with. Today they have thousands of dollars. They own their own large factory, have extensive interests in others, and do an enormous business. They have started a few other men in the glove business, and they will help you to start too, furnishing you with tools and equipments free, and teaching you the secrets of the business.

Unlimited Demand — There is no class of goods for which there is such a steady demand as for canvas gloves an. mittens. They are the popular glove for the masses. Everybody uses them—the farmer, the mechanic, the doctor, the lawyer, the merchant, the laborer—in all sections of the country—from Maine to California, and from Minnesota to the Gulf. There is actually room today for ten canvas glove factories where we only have one now.

We Mean Business when we say we furnish tools free, we mean exactly what we say. All we ask is that you buy your cloth from us, but we don't even ask that unless we can furnish it as low or lower prices than you can buy elsewhere.

Our interesting book which we send free. Write for it.

Our New Plan makes it easy for any man to start in business for himself. We give you free the necessary tools, such as expensive handmade dies, cutting table, maple cutting block, turning machine, cloth rack, rawhide maul, knife, pattern and equipment. No matter how small or how large your town—no matter what section you live in—there is always room for a factory. Any merchant can make the gloves he sells himself, and soon be making gloves for other stores.

No Experience is required. We teach you the secrets of the business and furnish you tools and equipments free. We have taken men who had never had a day's practical business experience, and started them on the road to wealth. These men started in a modest way, but soon built large factories work lots of help, have a big stock of cloth and machinery on hand and a good balance in the bank. What these men have done, you can do.

Don't Miss This opportunity, even if you have to borrow the small amount of money necessary to buy a stock of cloth to start with. You should be able to pay it back in a very short time and have money in the bank besides. There will be many fortunes made in the canvas glove business in the next few years. You can start a factory in any spare room at home, or small store room, and enlarge it as your business demands.

This Liberal Offer Your Stepping Stone to Success

We Start You in a business of your own, right in your own town. Every man, no matter how humble, is entitled to at least the profits of his own labor. If you have the ambition to better your condition—to be somebody—to provide for yourself and family—to enjoy success, happiness and prosperity—we can help you.

Come With Us and let us start you in this profitable, legitimate business, which, with a reasonable amount of light work and attention, should make you a prosperous factory owner in a very short time. The small amount of money which is required to be invested (from $50 upwards) is spent entirely for cloth, supplies and other necessities of the business. We furnish you the tools and equipment free. There is no waste material, no dead stock. Every yard of cloth can be turned back into cash.

OPPORTUNITY IS KNOCKING AT YOUR DOOR

Here Is a Chance where you can with our help start on an honorable career as a successful business man. You cannot possibly lose any time by investigation, and it may mean great financial success for you. **Do not delay.** Today the opportunity is open to you; tomorrow may be too late. Our ability to assist others in starting factories is limited to our ability to furnish them with raw material, and just as soon as enough have become associated with us to absorb our capital, we shall be obliged to withdraw this offer. **IF IS SO VERY EASY TO GET THE FULL DETAILS OF OUR PROPOSITION. SIMPLY SIGN AND SEND US THE COUPON.**

McCREERY MANUFACTURING CO.
206 Dorr Street, Toledo, Ohio

CUT THIS OUT AND MAIL TODAY

McCREERY MANUFACTURING COMPANY, 206 Dorr Street, TOLEDO, OHIO
Gentlemen, Please send me without cost a copy of your book and full information about starting in the glove business

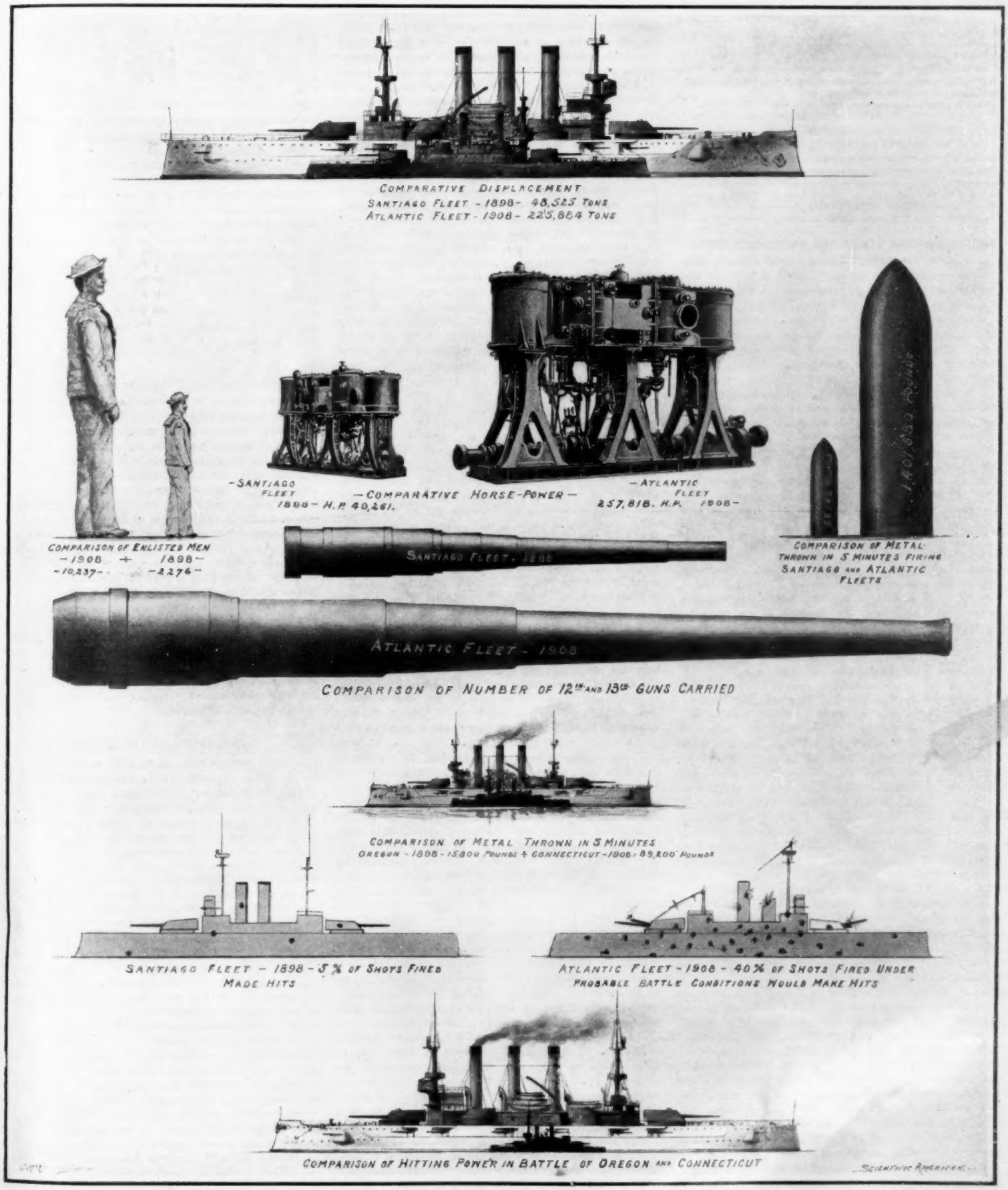
Name.....

Address.....

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1909, by Munn & Co.]

Vol. C.—No. 8. ESTABLISHED 1845. NEW YORK. FEBRUARY 20, 1909. [10 CENTS A COPY $3.00 A YEAR.


COMPARATIVE DISPLACEMENT
SANTIAGO FLEET - 1898 - 48,525 TONS
ATLANTIC FLEET - 1908 - 225,884 TONS
-SANTIAGO FLEET 1898- H.P. 40,261.
-COMPARATIVE HORSE-POWER-
-ATLANTIC FLEET 257,818. H.P. 1908-
COMPARISON OF ENLISTED MEN
-1908 + 1898-
-10,237- -2276-
SANTIAGO FLEET - 1898
ATLANTIC FLEET - 1908
COMPARISON OF METAL THROWN IN 5 MINUTES FIRING SANTIAGO AND ATLANTIC FLEETS
COMPARISON OF NUMBER OF 12" AND 13" GUNS CARRIED
COMPARISON OF METAL THROWN IN 5 MINUTES
OREGON - 1898 - 15800 POUNDS & CONNECTICUT - 1908 - 89,200 POUNDS
SANTIAGO FLEET - 1898 - 3% OF SHOTS FIRED MADE HITS
ATLANTIC FLEET - 1908 - 40% OF SHOTS FIRED UNDER PROBABLE BATTLE CONDITIONS WOULD MAKE HITS
COMPARISON OF HITTING POWER IN BATTLE OF OREGON AND CONNECTICUT
SCIENTIFIC AMERICAN

DIAGRAMMATIC COMPARISON OF THE SIZE AND POWER OF THE FLEET WHICH FOUGHT AT SANTIAGO IN 1898 WITH THAT OF THE ATLANTIC FLEET OF 1908, WHICH HAS RECENTLY CIRCLED THE GLOBE.—[See page 150.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*,
361 Broadway, New York.
FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845). ..... $3.00 a year
Scientific American Supplement (established 1876). ..... 5.00 "
American Homes and Gardens ..... 3.00 "
Scientific American Export Edition (established 1878). ..... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, FEBRUARY 20, 1909.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

LESSONS AND RESULTS OF THE BATTLESHIP CRUISE.

In view of the bitter criticism with which it was assailed, when the proposal to send a fleet of sixteen battleships from the Atlantic to the Pacific coast was first made public, the return of this same fleet to Hampton Roads after a 42,000-mile cruise around the world, with every ship in first-class shape and the *morale* of officers and men greatly improved, is a tribute to the far-sighted sagacity which projected the voyage.

It must be admitted, even by the most conservative, that the spectacle of this most imposing array of first-class fighting ships, steaming in perfect order and on schedule time from port to port across all the seven seas, has had the effect of raising the prestige of our navy in every quarter of the world. To those of us who keep in close touch with the development of naval construction, and are familiar with the pages of the naval annuals, the numbers and quality of the fighting ships of our navy and its relative strength, would be pretty well known, even if no opportunity were given to look at the ships themselves. But for the great world at large, diagrams and tabular comparisons give, after all, only a vague idea of what a fleet of modern battleships actually means. And, therefore, the presence of our ships in the leading ports of the world has afforded an object lesson as to the appearance, quality, and power of the fighting material of the American navy, which could have been obtained in no other way.

One of the most gratifying results of the cruise has been the enthusiastic and unmistakably friendly reception which was accorded at every port where the ships let go anchor. If any American imagined that the rapidly-increasing power and wealth of this country was regarded with suspicion, distrust, or active envy, surely the whole-hearted cordiality with which this concrete expression of our strength was everywhere received will effectually banish the idea from his mind. Our national policy of friendly isolation; of careful detachment from the entanglements of foreign alliances; has not been misinterpreted. It is significant, moreover, that the most splendid receptions of all were those accorded by the countries over which fly the British and Japanese flags; a fact that proves surely, if it proves anything at all, that keen naval and commercial rivalry need place no necessary embargo upon international amity and good will.

The fact that the fleet covered 42,000 miles without a breakdown of any consequence, and this, in spite of the fact that some very heavy gales of wind were encountered, should set at rest any doubt as to the quality of the machinery—a point upon which many fears were expressed at the outset of the cruise. Furthermore, the successful navigation of the fleet is a fine tribute to the ability of our officers to handle the largest ships in fleet formation, take them into and out of harbors of widely different character, and navigate them through seas and straits that require professional skill of the highest order when, as in this case, many ships are sailing the same course in close proximity to one another. Not a single ship has grounded or been in collision throughout the whole fourteen months of voyaging.

The ill-timed criticism made at the commencement of the cruise, to the effect that the time would be wasted and that the ships had much better be employed in regular practice cruises, maneuvers, and target practice, is shown to have been ill judged by the fact that, during the trip, the ships were constantly engaged in maneuvers and had lengthy target practice, and that during the latter, records were obtained which show the hitting power of our ships to be greater than at any period in their history. And just here it is fitting to say a word in praise of the enlisted men. Admiral Evans, in his recent autobiography, makes no effort to conceal his unbounded admiration for the American sailor; and he has repeatedly, during the last two or three years, stated his belief that man for man, our enlisted men are the equals, and in some respects the superiors, of any afloat. That his estimate is not too high is proved, surely, by the many tributes as to the fine appearance and behavior of our men, which have been freely given by government officials and the press in general at the various ports visited. In physique, education, intelligence, self-respect, and patriotism, the enlisted men of to-day stand at a higher level than ever before in the history of the American navy.

There is one fact brought out by the cruise, however, which must go far to offset the general satisfaction which must be felt at its successful completion. We refer to our great shortage of colliers, and to the fact that, had it not been for the foreign bottoms in which coal was shipped to the fleet at the various points of rendezvous, it would have been impossible for this voyage to have been made. It is not stretching a point too far to say that here we find the most important lesson of the whole cruise. Had war flamed out at the shortest notice, when our fleet was, let us say, on the coast of Australia, or at Suez, it would have been as helpless, and even more so, as a fleet of dismantled frigates in the days of sail power and the smooth-bore. With coal declared a contraband of war; with no colliers of our own available to carry the necessary fuel; our sixteen battleships, for all their tremendous fighting power, would have been as useless, as far as active operations on the high seas are concerned, as so many anchored, floating batteries. Undoubtedly, the greatest need of the navy to-day is a fleet of large and fairly fast colliers, built expressly for naval purposes.

Finally, the successful completion of the cruise must be considered as a sharp rebuke to those critics of our navy who, at the very hour that it was starting out from Hampton Roads, endeavored to persuade the people of America that these selfsame ships were poorly designed and defectively armored, and that in anything of a seaway the most important of their guns would be completely drowned out by the heavy water that would come aboard. None of these predicted troubles occurred. That the windward broadside batteries on the main deck would be washed with spray under certain conditions, such as did actually occur during the cruise, was fully expected; but this is a condition that obtains in the ships of every navy that carry broadside batteries on this deck. With this exception, our vessels have lived fully up to their designation as *seagoing* battleships; and the people of the United States may rest satisfied that ship for ship, gun for gun, they are the equals of any vessels of the same size and date in the navies of the world.

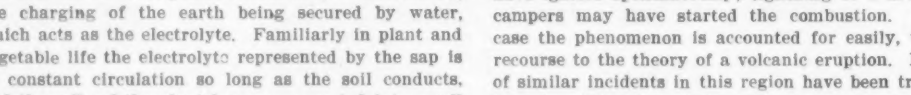
THE ELECTRIC POTENTIALITY OF FRUIT AND VEGETABLES.

In the course of some investigations in fruit and vegetable physiology an interesting discovery has been made by an English electrician. This is the conclusive fact that fruit, including nuts as well as grapes, apples or oranges, and vegetables are small secondary batteries or storage cells. True the degree of electric potential is slight, varying with the nature of the fruit or vegetable, but nevertheless a certain amount of electricity is stored within, the presence of which can be detected if a sufficiently delicate galvanometer is used.

The fact that the earth is always charged with negative and the air with positive electricity is well known, the charging of the earth being secured by water, which acts as the electrolyte. Familiarly in plant and vegetable life the electrolyte represented by the sap is in constant circulation so long as the soil conducts, and the cells of the plant become converted into small low-powered accumulators, there being at least one cell so charged by the earth and air in all representatives of the plant kingdom, whether tree, fruit, or vegetable. Moreover, this electric charge is retained, so perfect is the insulation by Nature, until the latter is either broken down by man or from the effects of decay which last named action serves to destroy the natural insulation between the positive and negative cells.

The process by which fruit becomes electrically charged is very simple. Negative electricity is supplied by the earth to the soil and the extent of such conductivity varies with the degree of moisture in the soil. Dry earth is a non-conductor, and this fact is strongly evident from the fact that unless the roots of the plant secure a certain percentage of moisture the plant dies. The moisture in the soil provides the sap which spreading upward flows to the uttermost extremities of the plant through the various arteries existing for such circulation. The leaves commence to burst forth, the buds becoming charged with negative electricity from the earth through the electrolyte. As the leaf expands it also becomes inductively charged with positive electricity from the air, as likewise do the flowers. When the fruit commences to form, however, nature provides an impermeable insulator represented by the rind or peel enveloping the fleshy portion of the fruit, but at the same time the negative charging continues from the earth to the seed center or core through the stalk, this central negative cell being insulated from the positive fleshy cell by a thin skin.

In order to test this thesis the experimenter secured a specially designed instrument of sufficient sensitiveness to record such an infinitesimal flow of electro-motive force as exists in the fruit. This constituted a Kelvin astatic galvanometer of 80,000 ohms resistance, in which the magnetic reflecting indicator is so light as to be suspended by the single thread of a spider's web. This instrument indicates the flow of current upon a special scale divided into millimeters. This scale may be represented by the following diagram:



When the negative terminal of a battery is attached to this instrument at the left-hand terminal the needle deflects to the right and *vice versa*.

The experimenter, instead of a battery, attached the stalk end of the apple which is the negative pole of the fruit, and the same effect was produced, but upon the lower end or positive pole being connected, the reverse deflection occurred. Such a reversal of sign could not occur merely by reversing the fruit if the action were due to chemical agency. Furthermore, such reversals were observed not to be momentary in character, but remained constant until the insulation was broken down or decomposition set in. In the course of his experiments with several types of fruit the investigator found the apple to be the most powerful cell, i. e., having the greatest degree of electric potential, while the orange was also found to be of large capacity. In this latter instance, and the peculiarity applies to all such fruits where the flesh is divided into separate sections, each alternate division is positively charged, the cells being insulated from one another by the skins inclosing each section. Such fruits therefore constitute in reality a combination of storage cells, additionally insulated by the rind or peel. In the case of the apple or pear the positive cell was found to comprise the fleshy portion, the core constituting the negative cell. By cutting such a fruit in half, the construction of the system may be plainly followed.

The experimenter is continuing his experiments in the same direction and many interesting developments respecting Nature's electric system, and the possible value of such from a dietetic point of view, are anticipated. In the case of vegetables the same peculiarity exists, although in a less pronounced degree, since the skins of many are very porous and consequently are not so efficient an insulator.

PSEUDO-VOLCANIC ERUPTIONS.

Recently reports were printed in various California newspapers to the effect that a volcano had burst forth in one of the canyons of the Santa Monica Mountains near Los Angeles. The point at which the pseudo-volcano broke out is about 200 yards from the Pacific Ocean and some twelve miles from the city of Los Angeles. Here sulphurous smoke rises from a little mound of Miocene shale and a few inches below the surface the ground is red-hot, charring or even setting fire to sticks thrust into it. But throughout this region oil-bearing shales are found near the surface and the soil is soaked with petroleum. The shale may have ignited spontaneously; lightning or a fire set by campers may have started the combustion. In any case the phenomenon is accounted for easily, without recourse to the theory of a volcanic eruption. Reports of similar incidents in this region have been traced to fires in oil-bearing strata. No serious harm has resulted from the fires, as the nearest oil-producing wells are at least ten miles away.

Recently there were accounts in some French papers of an eruption in an abandoned mine-shaft, and some years ago it was stated that there was an active crater on the top of an Alpine peak. The burning shaft produced a highly creditable imitation of an active volcano, great, heavy clouds of black smoke rising from it, and a fine, warm dust falling on the surrounding houses and fields, followed by flames and stones rained on the dwellings. The inhabitants in terror took flight; but an investigation proved that the pseudo-volcanic eruption had been caused by an explosion of fire-damp in the shaft. The basis for the story of an active volcano on the Alpine peak was a forest fire on a lower mountain.

AERONAUTICS.

A prize of $500 has been offered for a flight of one mile by an aeroplane above the beach at Daytona, Fla., on any day from March 23rd to 26th inclusive. These are the dates between which the automobile races occur, and every facility will be given aviators to test their machines.

A national grand prize balloon race has been organized to take place next June. The race will start from Indianapolis, Ind., June 5th. It is open to all pilot members of the Aero Club of America or affiliated clubs. Balloons of 2,200 cubic meters (77,693 cubic feet) capacity, or under, must be used, and entrants for this race will also be considered as competing for the Lahm trophy.

The danger which is likely to be met with when a balloon race is started near the sea, has again been emphasized by the finding of the body of Lieut. Foertsch, which was recovered in the North Sea, January 8th last. Both he and his companion lost their lives as the result of their balloon "Hergesell" descending in the sea in the distance race that started from Berlin last October.

Roy Knabenshue, the well-known aeronaut, has an agency for Curtiss motorcycles and aeroplanes in Los Angeles, Cal. In order to show the possibilities of the airship for dropping explosives, he recently made a night flight in his dirigible, and dropped dummy shells upon the city hall and other public buildings. The accuracy with which he frequently hit the mark was a rather startling demonstration of the possibilities in this direction.

Entries for the international balloon race for the Bennett trophy close on March 15th. The fourth contest for this trophy will start from Zurich, Switzerland, next October, it having finally been decided that the race last autumn was won by a Swiss balloon. The Aero Club of America is entitled to three entries, and it is to be hoped that these will be made, and that every effort will be exerted to again capture this trophy, which, it will be remembered, was first won by Lieut. Lahm in 1906.

Entries for the new Bennett aviation trophy, which was recently offered in France, close on March 1st. The course which has been decided upon for the first contest is around a circuit having a perimeter of from 5 to 10 kilometers (3 to 6 miles), the total distance to be accomplished being not less than 20 kilometers (12 miles) from start to finish. The machines will be allowed to alight and start again while making a circuit of the course. The Aero Club of America is entitled to three entries in this contest.

On February 9th a joint entertainment was held by the Automobile Club of America and the Aeronautic Society, in the club house of the former, in New York city. Representative Butler Ames, of Massachusetts, described a new and very interesting type of flying machine of his own invention. This machine consists of a number of short rectangular planes, placed at right angles to each other upon a longitudinal axis and separated by vertical disks. Two rods set at a slight dihedral angle, and each carrying a number of planes, were revolved by a gasoline motor of about 30 horse-power, and Mr. Ames claims to have gotten off the ground once or twice for a short distance. A model of his machine was tested by the towing apparatus in the naval towing tank at Washington, where it was found that while the lifting power increased as the square of the speed, the resistance increased only directly as the speed. The machine resembles a number of air paddles. It is quite peculiar in appearance, and is extremely simple.

At the same meeting Mr. Hudson Maxim made an address upon the backwardness of America as far as governmental recognition of aeronautics is concerned. He stated that instead of not allowing the $500,000 appropriation which recently failed to pass the House of Representatives, that body should have granted $5,000,000 for aeronautical purposes. He showed how the perfecting of the aeroplane and airship will bring about the necessity of the defense of all places by similar aerial craft. His address was a stirring one, and it was received with great enthusiasm. Moving pictures were afterward shown of Wilbur Wright, Farman, and Curtiss in flight on their aeroplanes, and anyone seeing these could not fail to be convinced that the age of aviation has arrived at last. Mr. M. O. Anthony demonstrated a new method of wireless control for airships. Both his sending and receiving antennæ consisted of two parallel rods suspended one above the other some 6 feet apart. By means of other special apparatus he was able to start, stop, or reverse a small electric fan run by a storage battery and located at the other side of the room. He already has a 20-foot dirigible operating successfully under wireless control, and a new one three times as large, at present being constructed by Leo Stevens, will be ready in the near future.

ELECTRICITY.

In the British House of Commons a member has asked the consideration of a regulation compelling electric cars, among other vehicles, to carry speedometers, that the public be safeguarded against reckless speeding and the motormen protected against the charge of exceeding the speed limit.

A company has been formed in Cologne to lay a submarine cable connecting Germany with her colonies. The first section will be laid this year, running from Borkum to Teneriffe. Thence the cable will run to Monrovia, Liberia, and from this point to Pernambuco. The entire length of the cable will be 7,000 miles.

The Indiana Legislature is taking steps to insure better seating capacity in its interurban cars. A bill has recently been introduced, which will require those passengers who are not provided with a seat to pay only half fare. In case the passenger offers a ticket, the conductor must give him a rebate check, which can be cashed at any ticket office.

The Bureau of the Census has just published a preliminary report on the telephone industry in continental United States, exclusive of Alaska. The number of lines and systems is given as 22,971, with a total single-wire mileage of 12,999,369. Over these wires it is estimated that during the year 1907, as many as 11,372,605,063 messages were delivered. The telephone industry gave employment to 143,721 men and women, and the salaries and wages totaled $68,279,127.

The employees of the Spokane and Inland Empire Electric Railroad Company are now given the opportunity of becoming stockholders in the company. Arrangements have been made with a trust company of Spokane, to furnish any officer or employee of the company with shares of preferred stock at the market price, with a five per cent commission, which is the only profit made by the trust company. The stock may be purchased by paying 15 per cent of the purchase price in cash, and the rest in payments over a period of not longer than five years. It is believed that this arrangement will be of benefit to the employer and employee as well, because it will encourage the latter to work for the mutual good.

The value of wireless telegraphy, in case of danger at sea, was so conclusively demonstrated during the recent accident to the "Republic," that Congress is now considering the question of requiring all vessels that engage in coastwise trade or that touch at ports of the United States, to be equipped with wireless telegraph apparatus. In discussing the bill which is now before Congress, Lieut. Sweet of the navy brought out some interesting facts about wireless telephony, as used in the battleship fleet. He states that conversations were held over a distance of 12 miles, although in some instances the apparatus failed to work satisfactorily. It has been recommended that vessels on the Great Lakes be permitted to use the wireless telephone instead of the telegraph, if they so desire.

Very few of us have any trouble in counting our coin by hand. In mints, however, in banking houses, in the offices of electric railways, and in many other establishments, vast quantities of coin have to be counted and packed daily. An electrical machine lately devised counts coins of any size from pennies to dollars, and wraps them at the rate of 420 per minute as long as the current is transmitted and the coins are fed into the hopper. An expert, while he is in good working order, can count and wrap fifty coins a minute; so it will be seen that the machine does the work of eight men. It takes one man to run the machine. His work consists in sorting the coins, picking out plugged pieces, blanks, and buttons, which in some cases seem to get mixed with good money. The machine receives the sorted coins at one end, and delivers them all smoothly rolled in bunches to suit and with the wrapper pasted. It is the invention of a man whose business it was to collect coins from slot machines and to sort, count, and bundle them.

During the earthquake and fire at San Francisco, the trolley poles in the city were badly bent. How to repair this damage proved quite a serious problem. It was considered impractical to take out the poles, straighten them, and then replace them, and the other alternative of tearing them up and putting in new poles involved too much expense. The problem was finally solved by straightening the poles without removing them from their positions. The method of doing this, as described in a recent issue of the Electrical Railway Journal, is quite interesting. The apparatus used consisted of a 10-foot section of railway rail and two U bolts, with wooden fulcrum block. The rail was fastened to the upper end of the pole on the convex side of the bend by means of one of the U bolts, the legs of which passed through the flanges of the rail. Just below this the fulcrum block was placed, and then the lower end of the rail was forced inward against the pole by turning the nuts on the second U bolt. The cost of straightening the poles averaged about $3.50 each, whereas if new poles had been used to replace the bent ones, the cost would have been $40 each.

SCIENCE.

Capt. Roald Amundsen's polar expedition is now assured, for the Storthing has voted him a subsidy of $18,000, necessary for the outfitting of Nansen's famous ship, the "Fram."

Under the new laws in effect in New York State, there are oculists, opticians, and optometrists. The optician seems to have lost importance, as the optometrist is one who ascertains and prescribes the character of the lens. The technical optician simply grinds the lens in accordance with directions from the optometrist and manufactures spectacles and eyeglasses. The oculist is a surgeon who treats the diseases of the eye.

The Navy Department, by its specifications for supplies to the fleet, has ranged itself against Dr. H. M. Wiley, chief of the Bureau of Chemistry of the Department of Agriculture, in his fight to prevent the use of benzoate of soda as a food preservative. In a specification issued on October 23rd last year for the supply of 600 gallons of tomato catsup, it is expressly stated that the only preservative to be used is benzoate of soda, and the proportions are left to be filled in by the firm bidding for the contract.

Prof. Florence has devised a new method of examining and photographing opaque microscopic objects. Applying this method to the examination of traces of blood on weapons, he was able to recognize distinctly red blood corpuscles which had escaped discovery by expert examiners. The method, which is susceptible of other than medico-legal applications, is characterized by the fact that the light by which the object is illuminated is admitted into the tube of the microscope, whence it is reflected by prisms to the object glass, which converges it upon the object.

In a system of construction laid before the 14th international hygienic congress, which met this year in Berlin, each story of a house projects from three to six feet beyond the story next above, and the width of the terraces thus formed is increased several feet by balconies. By this means every story is abundantly provided with light and air and also with an open space for outdoor recreation. The system is recommended especially for sanatoriums and dwellings for the poorer classes. As building material, reinforced concrete is indicated, for structural as well as hygienic reasons.

It is proposed to erect a monument in honor of Prof. E. J. Marey, who may be called the father of the moving picture. The cost of the monument is to be defrayed by international subscription. The International Association of the Marey Institute has already received the promise of many contributions from various countries. In France a committee, of which the minister of public instruction is the honorary president and M. Chareveau of the French Institute is the active president, has been formed for the purpose of soliciting and receiving contributions from the friends, admirers and former pupils of the deceased scientist. Contributions may be sent to M. Carvallo, Institut Marey, Boulogne-sur-Seine, or to the publishing firm of Masson et Cie., 120 Boulevard Saint-Germain, Paris.

The number of recognized asteroids is now 659, and it is not unlikely that 700 of these minute planets will soon be officially numbered and catalogued. Photography is reaping a rich harvest in this field, and hunting for asteroids is pursued almost as a sport by Metcalf, Palisa, Kopff, Lorenz, and other astronomers. At Arequipa, Peru, 17 known and 47 previously unknown asteroids were photographed between 1898 and 1901. It will be readily understood that the discrimination between known and unknown asteroids caught by photography entails long and arduous work, and it is not surprising that a long interval of time sometimes elapses between the making of the photographs and the definite enrollment of the asteroid as a new one or its identification with one already known. The swarm of little planets between the orbits of Mars and Jupiter is far from having been exhausted, and smaller and smaller members will be added with each improvement in methods and instruments.

Lunar rainbows are seldom observed in the temperate zone. Very likely the physical phenomenon occurs frequently but is invisible because of the faintness of the moon's light. On September 12th, 1908, an observer at Coxyde saw, to the northwest, over the sea, a band of light, striped horizontally but without perceptible color. The band moved slowly eastward and remained visible nearly all night. On the following day this observer learned that a lunar rainbow had been seen at the epoch of full moon, on September 10th. In the tropics, where moonlight is more intense, lunar rainbows are more frequently observed. They are by no means rare at Reunion Island. At all places the phenomenon is most frequently seen at full moon when the moon's light is highest, but it has been seen in various phases of the moon. It was first observed by Aristotle. A lunar rainbow is produced at full moon by the spray of the great Victoria Falls of the Yguassu, in Brazil.

COMPARATIVE STRENGTH OF THE NAVIES OF THE WORLD.

There are few tasks that have proved more puzzling to the statistician than that of arranging the navies of the world according to their comparative strength. For the term strength, as applied to naval and military *materiel*, is an elastic term, and the value of any tabular comparison will depend upon the basis upon which it is made. If the total number of units in a fleet be taken as the basis we shall get one order of rating; if the total displacement, we shall get another. If it be considered that the number and displacement of battleships is a true test of comparative strength, the standing of the navies will receive still another readjustment; while if what we ourselves consider to be the true test, that of all armored vessels, whether battleships or armored cruisers, be adopted, there will be yet another change of position.

Among the many comparisons that are made annually of the relative strength of the world's navies, one of the best is that compiled at the end of each year by the United States Navy Department. The data on which it is based are compiled from government documents, and probably afford the most correct information obtainable. The figures which follow show the number and displacement of warships, built and building, of 1,000 or more tons displacement, and of torpedo craft of more than 50 tons. From these figures are excluded all vessels that are over twenty years old, except in cases where they have been reconstructed and rearmed since the year 1900. The vessels that are authorized, but not yet actually begun, are also excluded; as are also all transports, colliers, repair ships, torpedo-depot ships, converted merchant vessels, and yachts.

Taking, then, everything, big and little, subject to the above exceptions, we find that the British navy still maintains its commanding lead, including, as it does, 482 ships of a total displacement of 1,871,176 tons. France comes second with 516 vessels with a total displacement of 801,188 tons. Third place is held by the United States, with 173 vessels and 770,468 tons displacement; followed by Germany with 222 ships of 693,599 tons, and Japan with 179 ships of 444,903 tons. It is interesting to note that, although France leads the United States in total displacement and total number of ships, the average size of the individual unit is just three times as great in the United States as it is in the French navy, being 4,460 tons in the former case, and 1,553 tons for the 516 ships of the French navy.

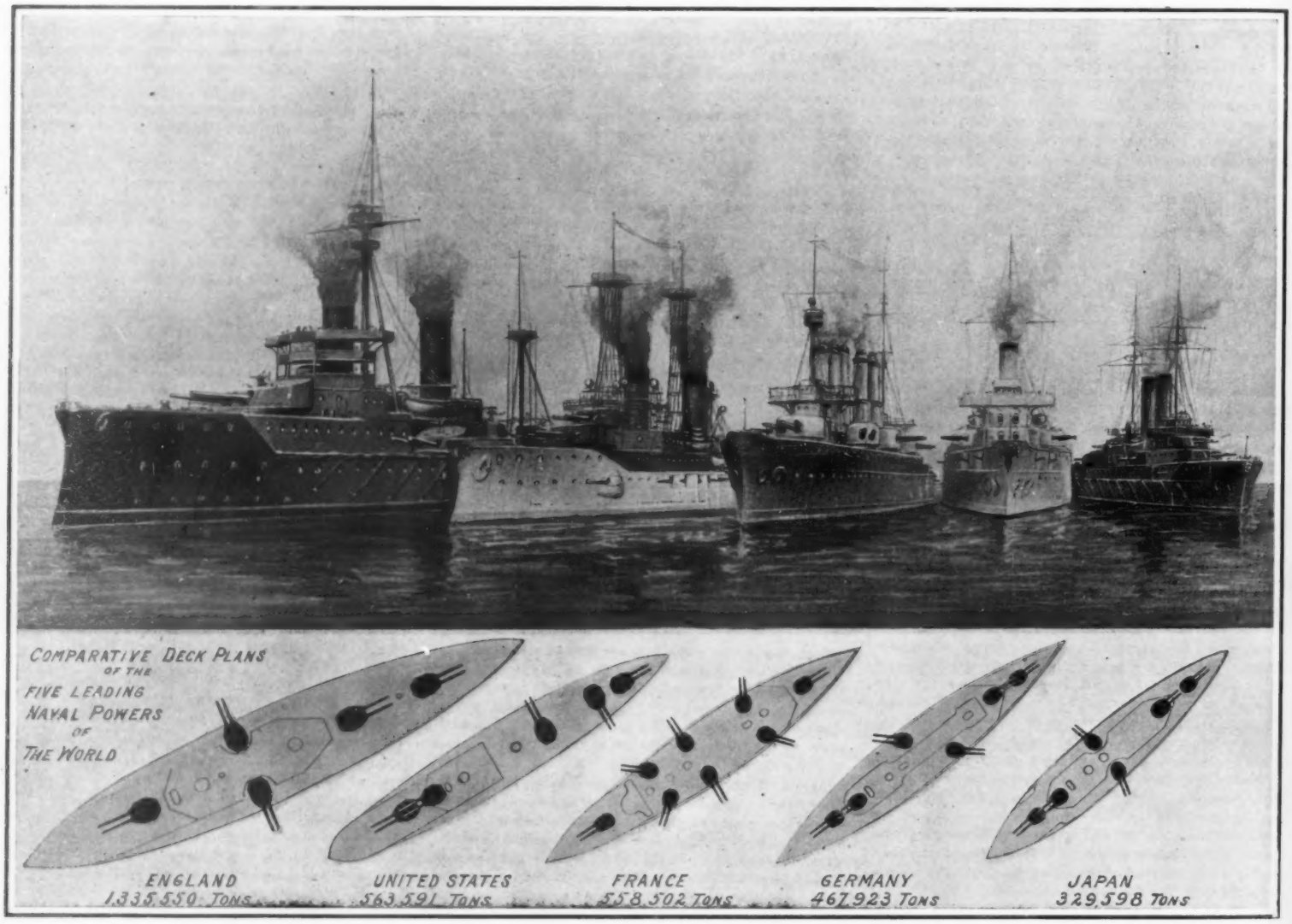
A most valuable quality in those officials who have charge of the planning and construction of the fighting material of a navy is the capacity to foretell, years ahead of its fulfillment, the trend of future developments; and it is to the possession of this quality by our Bureau of Construction, more than to the appropriations of Congress, that the United States owes its present strong position as the second naval power in the world. Many years ago we ceased building warships of the protected cruiser class, and began to put practically the whole of the displacement authorized by Congress into ships of the armored type, either armored cruisers or battleships. Pushing this policy still farther, after we had built a dozen armored cruisers, we ceased their construction altogether, and outside the building of a few scouts, torpedo boats, and submarines, have invested our displacement entirely in capital ships of the very first size and power.

As a consequence of this policy, in a comparison taking note only of armored vessels, that is, vessels whose sides at the waterline and for some distance above it and below it are protected by heavy armor, we find that Great Britain ranks first, with 76 armored ships of 1,335,550 tons total displacement. The United States is second with 41 ships of 563,591 tons displacement. France is third with 47 ships of 558,502 tons; followed by Germany with 38 ships and 467,923 tons, and Japan with 26 ships of 329,598 tons.

It may be objected that recent developments, especially since and including the Russo-Japanese war, have depreciated the value of the armored cruiser so greatly that the possession of a fleet of these ships should not be allowed to vitiate the value of a comparison of fighting strength, which can only be accurately made when battleships alone are included. Therefore, we submit herewith figures based on the number and displacement of battleships alone, in which it is found that Great Britain still heads the list with 58 vessels of 867,200 tons; followed by the United States with 29 ships of 406,146 tons; Germany, with 28 ships of 354,031 tons; France, with 24 ships totaling 337,520 tons; and Japan making a poor fifth with 191,498 tons.

It will be noticed, however, that we have preferred in the accompanying illustration of the comparative fighting strength of the navies, to base it upon the collective battleship and armored cruiser strength; for, although many of the armored cruisers, particularly in the French navy, carry armaments of comparatively small offensive power, the guns being few and of small caliber, it must be remembered, on the other hand, that many of the vessels included under the head of armored cruisers more strictly belong in the class of battleships, and this is particularly true of the British and German navies. The three armored cruisers of the "Indomitable" class, in the British navy, of 17,250 tons displacement, which are able to carry their batteries of eight 8-inch guns across the high seas at speeds of 25 knots and over, are surely more battleship than cruiser. The latest German armored cruisers, also, are 25-knot ships, carrying a battery of twelve 11-inch rifles. Japan also is entitled to call her latest armored cruisers battleship-cruisers, since they carry the 12-inch gun as their main armament. France, on the other hand, although she possesses twenty-three armored cruisers, whose total displacement is two-thirds of that of her battleships, does not possess a single vessel in the armored cruiser class that is entitled by virtue of its battery and protection to "lie in the line" against battleships and receive the hard knocks of a first-class engagement. Hence, although in total displacement of armored ships she exceeds Germany, strictly speaking she ought to take the fourth position, yielding the third place. Germany, on the other hand, includes among her battleships a large number of vessels which carry nothing heavier than a 9½-inch gun of rather low velocity, and these vessels go far to offset the advantage possessed by Germany in the number and power of the ships of the "Dreadnought" class which she now has under construction.

Attention is directed to the comparative deck plans of the five leading naval powers, as shown in the accompanying engraving. Each represents the type ship now being built by the various nations in the "Dreadnought" class; and, taken with the wash drawings of the ships as they appear afloat, they serve to convey a closely correct impression of these powerful fighting vessels. The British navy is represented by the "St. Vincent," one of a class of four. The length is 530 feet, beam 84 feet, displacement 19,250 tons, and the belt and 12-inch gun protection consist of 11 inches of Krupp armor. The armament consists of ten 12-inch



The deck plans show the number and disposition of guns on the latest ships of the "Dreadnought" type in each navy.

THE COMPARATIVE STRENGTH IN BATTLESHIPS AND ARMORED CRUISERS OF THE LEADING NAVIES OF THE WORLD.

guns of 50 calibers length—a new piece with a velocity of 3,010 feet per second, and an energy of 54,200 foot tons. By placing two of the turrets amidships, one on each side of the superstructure, the end-on fire is increased at the expense of the broadside fire. Six 12-inch can be fired ahead, eight astern, and eight on each broadside. The forward pair are mounted on a lofty forecastle deck, and the wing guns and four after pairs of guns on the main deck, the forward of the two after pairs of guns being raised sufficiently to fire over the after pair.

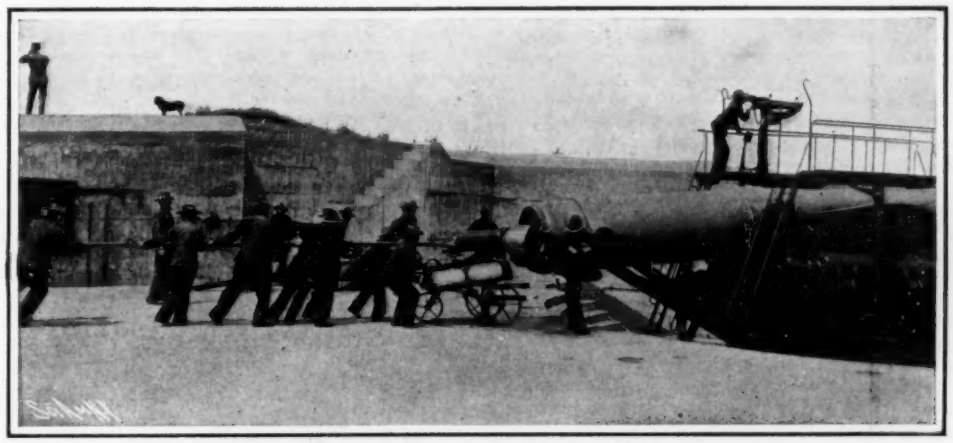
The "Florida" is the type ship of the American "Dreadnought." She is 518 feet long; 20,000 tons displacement; is protected by 11- to 12-inch armor, and mounts ten 45-caliber guns on the axis of the ship, so disposed that four can be fired ahead, four astern, and ten on each broadside. Her broadside fire is therefore 25 per cent greater than that of the "St. Vincent."

France is represented by the "Danton," 480 feet long; of 18,400 tons displacement; armed with four 12-inch 50-caliber guns, two forward and two aft, and twelve 9.4-inch 50-caliber guns mounted in turrets six on each broadside. The armor is from 10 to 12½ inches in thickness.

Germany is represented by the "Nassau," a 19,000-ton ship, 472 feet in length. If there was any mistake made in arming the earlier German battleships with too light a battery, no such criticism can be directed against this latest design. By mounting two of her turrets *en echelon* amidships, the Germans secure from their twelve heavy armor-piercing guns of 11-inch bore and 50 calibers length the heaviest broadside of any of the "Dreadnoughts"—the heaviest, at least, in the total number of large guns that it includes. At the same time, her end-on fire is also heavier than that of any other ship of the "Dreadnought" type. Two pairs of turrets are mounted forward, the guns of one firing over the other; two turrets are mounted similarly aft, with the result that the "Nassau" can deliver a fire of eight 11-inch guns ahead, eight astern, and twelve on each broadside.

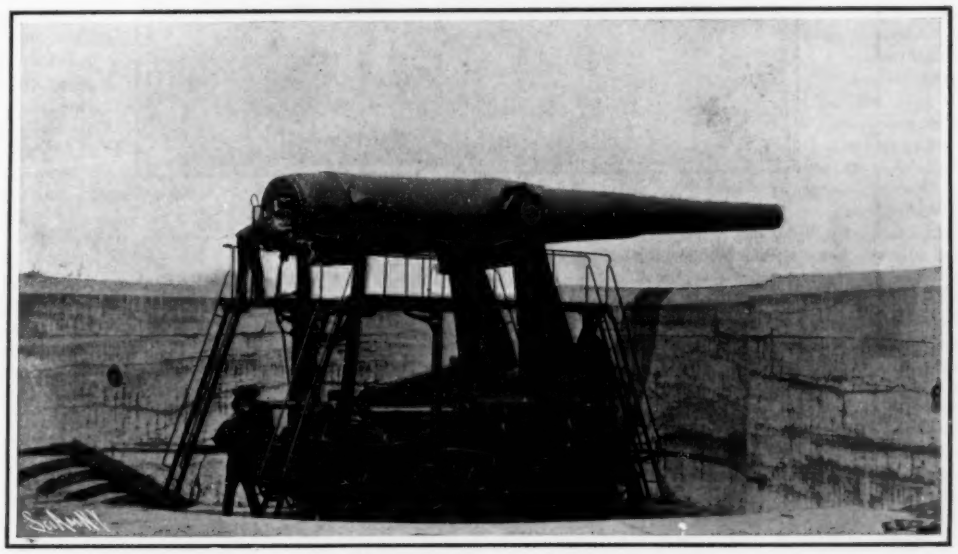
The Japanese are represented by a ship of about 21,000 tons displacement and 481 feet total length, carrying twelve 45-caliber 12-inch guns in six turrets, two forward and two aft, arranged as in our own "Florida," and two amidships, one on each broadside, the concentration of fire being eight ahead and eight astern, and ten on the broadside.

So much for a comparison of the fighting strength of the navies of the world based upon the total displacement of the battleships and armored cruisers. If the mere question of tonnage, or even of the number of guns carried and the thickness of the armor, alone determine fighting strength, the accompanying diagram would pretty closely represent conditions. But there is another element of strength, perhaps the most important of all, which might entirely alter the relative standing. We refer to the human element—the skill of the admirals and officers in strategy and tactics; the accuracy of the men behind the guns; the general *morale* of the whole fleet. Japan has recently proved her efficiency; and we know that in skill, discipline, and courage her navy apparently leaves little to be desired. The published reports of the target practice in the British navy and in our own would make it certain that the shooting of these two navies is of a very high order. In the United States navy, when the ships have been firing under battle conditions, the average of hits has risen, in the case of one ship, as high as eighty per cent, and the average for the Atlantic fleet is probably about sixty per cent. The results obtained on the recently completed voyage around the world would give us reason to believe that both the ships and the personnel have reached a point of excellence which is fully equal, and perhaps superior, to that of any other navy.

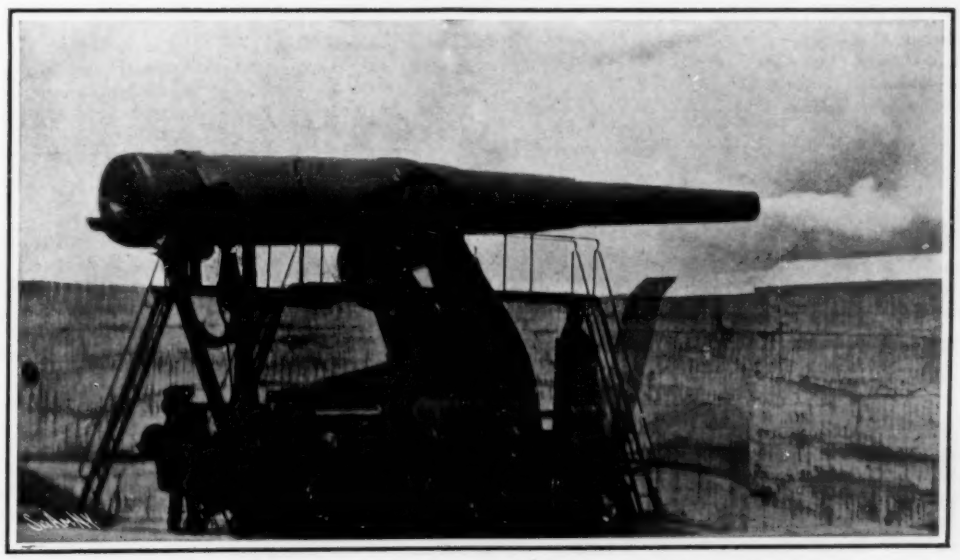


The gun is below the parapet, protected from the enemy's fire.

Loading a 12-inch coast-defense gun.



Loaded and elevated, ready to fire.



The recoil; gun swinging back and down to the loading position.

OUR SYSTEM OF SEACOAST FORTIFICATIONS.

The best system of defense of the seacoast of the United States is an adequate fleet of seagoing battleships, and the nearer this line of defense can be placed to the coastline of the enemy, the more secure from attack will be our own seaboard. If, however, a fleet of the enemy's battleships should arrive off our coast, after either meeting and destroying our own fleet, or skillfully eluding it, the defense of our maritime cities must depend upon fixed seacoast fortifications and their accessories. The present scheme for seacoast fortifications is outlined in the report of the National Coast Defense Board, under date of February 1st, 1906. The original scheme, as drawn up by a similar board, in 1886, has been practically completed, and our principal harbors and seacoast cities may be considered as well equipped for defense. The fortifications are equipped with batteries of 12-, 10-, 8-, 6-, 5-, 4.7-, and 3-inch guns. The heavy 12-inch and 10-inch guns are mainly relied upon to prevent the approach of the enemy through the channels and entrances defended. They are mounted upon heavy foundations of concrete, and protected in front by parapets of the same material and of great thickness, in front of which are deep sloping embankments of earth. The majority of the guns are mounted, similarly to the 12-inch gun which forms the subject of our illustration, upon what is known as the Buffington-Crozier disappearing gun carriage. In this mount the gun is pivoted at one end of a pair of massive levers, at the other end of which is suspended a weight which is sufficient, after the gun is loaded, to bring it into battery above the parapet. The gun is brought back and down to the loading position by the energy of the recoil. While in the loading position, it is entirely below the parapet, and both the gun and the gun detachment are fully protected from direct fire. The ammunition is kept in massive concrete ammunition rooms, from which it is wheeled on a truck, as required, up to the open breech of the gun, and loaded into the powder chamber. The sighting of the gun is done while it is in the depressed position. At the word of command a catch is released, and the heavy counterweights bring the gun into battery above the parapets. This disappearing mount is used for the 12-, 10-, and 8-inch guns.

Our latest 12-inch coast defense gun has an initial velocity of 2,550 feet per second, and a muzzle energy of 47,299 foot tons. If it strikes a normal blow (a blow at right angles to the plate) it can penetrate the 12-inch armor of battleships at 8,700 yards, and the 7-inch armor of armored cruisers at all practicable fighting ranges. To obtain this energy, it is necessary to use such a high pressure in the powder chamber that the corresponding high temperature and high velocity of the gases burns and abrades away the interior of the gun, shortening its life to such an extent that, after sixty rounds, it loses its accuracy. With a view to preventing this rapid deterioration, the Board of Ordnance have decided to build a bigger gun, firing a heavier projectile with a lower powder pressure, thus

---

Gray Stain for Ivory.—Lay the parts in a solution of 1 part of pyrogallic acid in 20 parts of water, for about 20 minutes, allow them to dry thoroughly, then immerse in a solution of 1 part of green vitriol in 25 parts of water.

reducing the temperature of the gases and the consequent erosion. A 14-inch caliber has been adopted, and several guns are being built. The new 14-inch gun will fire a projectile of 1,660 pounds, with a muzzle velocity of 2,150 feet per second. It will have about the same penetrating power at 8,700 yards as the 12-inch gun; and it will carry a bursting charge of high explosive over fifty per cent greater than that of the 12-inch projectile. Because of its shorter length, its weight, 49.5 tons, will be about the same as that of the 12-inch gun.

There are several objections to the 14-inch gun. In the first place, the rate of fire will be necessarily much slower than that of the 12-inch. Another objection is that the trajectory, or curve of flight, of the projectile is not nearly so flat as that of the 12-inch gun, and, therefore, the danger space, in which the enemy is liable to be hit, is less. On the other hand, instead of losing its accuracy after firing sixty rounds, the 14-inch gun would fire 245 rounds before deterioration set in. The original plan for arming our coast defenses included a large number of 16-inch guns. Only one of these, however, has been built. It is at present at Sandy Hook, where it underwent its trial successfully, but we believe it has not as yet been mounted in any permanent emplacement. This huge gun, the most powerful in the world, weighs 74 tons, and fires a 2,400-pound projectile with a muzzle energy of 77,000 foot tons, and a remaining energy at 8,000 yards of 40,540 foot tons. Its rate of fire is thirty rounds per hour, and it will lose its accuracy after 175 rounds. The gun cost nearly $200,000. It is too costly, and its rate of fire too slow, to make it a suitable weapon of defense against modern 50-caliber 13½- and 14-inch guns, such as are now being contemplated by foreign navies, whose striking energy will be not very much less at ordinary fighting ranges, and whose rate of fire will be at least four times greater. Hence, we are not likely to build any more 16-inch guns.

Although the heavy guns mainly will be depended upon to prevent the approach of the enemy, there will be two auxiliary elements, the submarine boat and the submarine mine, which, in our opinion, will be even greater deterrents in keeping the enemy well off-shore. The submarine is no longer an experiment, at least for sea-coast defense. An enemy's fleet attempting to enter, let us say, New York harbor, must be prepared, at any time after it has passed the three-mile limit, to receive the blow of the torpedo, delivered by an unseen and practically undetectable enemy. Should the fleet evade the submarines, at a distance of five miles it would come within range of the 10-, 12-, and 14-inch guns, and, because of the wonderful accuracy of modern range finders, these guns would be laid with deadly accuracy. Should the attacking fleet, however, pass without mortal injury through this five-mile zone of armor-piercing fire directed upon it from Sandy Hook, and through another five miles of fire of triple intensity, rained upon it from the combined batteries of Sandy Hook, Fort Wadsworth, and Fort Hamilton, it would have to pass through one or more fields of submarine mines laid in the manner described and illustrated in our issue of January 23rd, 1909.

Now, a modern battleship costs from $8,000,000 to $10,000,000, and it might take but one blow by gun, torpedo, or mine to so cripple the ship as to place it at the mercy of the coast defenses. Moreover, the bombardment of cities will prove merely a strong irritant, and can never exercise a conclusive effect in determining the issues of a war. It is very unlikely that the costly battleships of the future will engage seacoast fortifications—certainly they will never risk the enormous losses involved in forcing an entrance through well-defended harbors such as those of New York, Boston, or San Francisco.

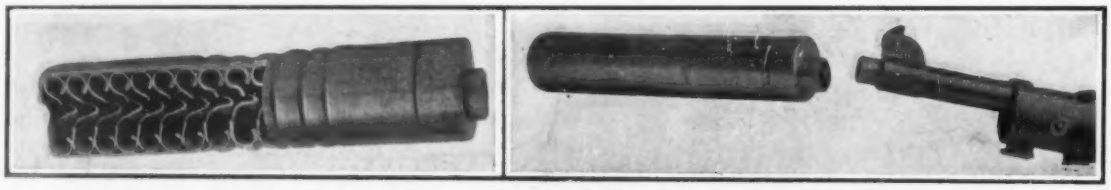
THE SILENT GUN.—COUNTERPART OF SMOKELESS POWDER.

The public demonstration by the inventor, Mr. Hiram Percy Maxim, of his silent gun introduces a weapon which is destined to affect the conduct of military operations of the future in much the same way, and to almost the same degree, as did the introduction of smokeless powder. For many years past the military authorities have been devising ways and means for rendering the presence and movement of troops invisible. The first successful step in this direction was the introduction of smokeless powder, and this was followed up by a careful study of the uniform and equipments, in the effort to secure those colors which would blend most completely with the surrounding landscape, and render the presence or movement of troops difficult of detection. Smokeless powder and earth-brown khaki suits have done wonders in this direction. So perfect is the concealment, that, were it not for the rattle of the discharge of musketry, it would be well-nigh impossible definitely to locate the positions of a line of skirmishers, or even of a large body of troops taking advantage of natural cover. In determining the position of the enemy and strength of the attacking force, the leader of a body of troops is dependent almost entirely upon the sound of the enemy's rifles. In reading descriptions of battles, either by war correspondents or as contained in official reports, one frequently comes across such a phrase as this: "There was a sound of heavy firing on our right." If the sound of discharge could be eliminated, the principle of concealment would be worked out to theoretically perfect conditions; for it would be possible for an attacking force to deliver its fire, without the enemy having the slightest idea as to the range or direction from which it was delivered, or the strength of the force engaged.

Front view of a disk. A military rifle with silencer attached.

The recent public demonstration made before a party of invited guests, including a representative of the Scientific American, occurred in an office building in this city, where a temporary shooting range, about 15 feet in length, had been erected, at the far end of which was a box of sand to receive the bullets. For the purposes of the test, a dozen modern rifles of high power, in which were included the best-known military rifles of Europe and America, had been provided, and from each of these a couple of shots were fired—one without the silencer, and the other with it attached.

The silencer is a small sheet-steel tube, 1½ inches in diameter, and from 4 to 6 inches in length according to the gun to which it is attached. For a .22-caliber rifle, it is about 4 inches long, and for a .30-30 rifle it is 6 inches long. The weight varies from 6 to 9 ounces.



Half sectional view, showing the method of assembling the spiraled disks. The silencer ready for screwing on to the threaded end of barrel.

THE SILENT GUN.—COUNTERPART OF SMOKELESS POWDER.

The silencer is attached by pushing it home on the barrel, and giving it a quick three-quarter turn to engage the threads. The report of a rifle is due to the sudden liberation of the powder gases, which occurs immediately after the base of the bullet has left the muzzle. The gases, rushing out, expand into mushroom form, and their impact on the air causes the characteristic sound of a swiftly-delivered blow. The object of the silencer is to arrest these gases; change their forward direction into a rotary one; slow down their velocity; and allow them to pass out through the air so gradually as to produce a but slightly audible sound. The principle upon which this is done was illustrated in a very homely way by the inventor, when he likened it to the effect produced when the stopper is taken out of a basin full of water, and a swift rotary motion is imparted to the contents, when the centrifugal force holds the water against the sides of the basin. As the rotary motion decreases, the water begins to descend and flow through the plug hole, the basin being slowly emptied. In the silencer, the gases are caught upon a series of spiral vanes, where their motion is turned from a rectilinear to a circular one. After the velocity is decreased, they flow out gently and without sound.

The construction of the silencer is shown very clearly in the half-sectional view, and in the photograph of one of what might be called the small turbine elements. Each of the latter consists of a sheet-steel disk, having a hole near the center slightly larger than the bullet, and with its outer edge turned over, so as to form an annular path in which the gases rotate. The inventor describes the action of the device as being practically the reverse of that of a turbine engine. In a turbine-driven engine the gases advance in an approximately rectilinear line, parallel with the axis of the turbine; and their effect is to make the bucket wheel revolve. In the silencer the bucket wheel or rotary blades are held fast, and as a result the steam, or gases, as in this case, are given the rotary motion. The central holes in the disks are all aligned perfectly with the axis of the rifle; and, as they are slightly larger in diameter than the bullet, the latter passes through them without being in any degree affected as to its velocity or accuracy. The gases, as explained above, are caught in the successive disks; their motion is changed from a rectilinear to a circular or spiral one, and their velocity is gradually reduced to a point at which they fail to make any audible concussion on leaving the silencer. In the demonstration referred to, the audible sound was mainly that produced by the impact of the bullet in the bed of sand and the click of the firing mechanism. In tests which had previously been made by the army authorities, observers standing several hundred yards away from the gun were able to hear only the ripping sound of the bullet as it cut its path through the air, and the blow as it struck the target.

SANTIAGO AND ATLANTIC FLEETS COMPARED.

It is probable that few people, outside of the navy, appreciate the astonishing growth which has taken place in the fighting power of our ships during the ten years intervening since the Spanish war.

We can vividly recall the profound impression of the destructive power of our little fleet of battleships under Admirals Sampson and Schley, which we all felt on reading the dispatches of July 4th, 1898, announcing that in a few brief hours their guns had completely annihilated the ships of Cervera's squadron, setting them on fire; driving them ashore, or, as in the case of the torpedo boats, quickly sending them to the bottom. In the present hour, when the Atlantic fleet of sixteen battleships have returned intact to a home port after a voyage of 42,000 miles around the world, it is opportune to compare this armada with that which made the eventful voyage to the south coast of Cuba to find and destroy the fleet of the enemy.

To state that in the fleet of 1908-9 there are sixteen battleships as compared with the five which we were able to muster off the south coast of Cuba, is to merely lay the foundation for our comparison. In the intervening period there has been a steady increase in the size of the battleship, until the largest unit, represented by the flagship "Connecticut," is over fifty per cent heavier than the "Oregon," our most powerful fighting ship in 1898. The Santiago fleet consisted of five battleships: the "Oregon" class, of 10,288 tons displacement; the "Iowa," of 11,410 tons; and the "Texas," of 6,300 tons. The total displacement of the fleet was 48,525 tons. The Atlantic fleet as it steamed into Hampton Roads consisted of five battleships of the "Connecticut" class, each of 16,000 tons; five of the "Virginia" class, of 14,948 tons; two of the "Ohio" class, of 12,500 tons; two of the "Alabama" class, 11,552 tons; and the "Kearsarge" and "Kentucky," of 11,500 tons; the total displacement of the fleet being 225,884 tons. In displacement, then, the Atlantic fleet is four and three-quarter times that of the fleet that fought at Santiago.

Mere size, however, is of little value, unless it is taken in connection with other elements of efficiency; and the first among these that we will consider are those of horse-power and speed. The "Oregon" class were designed for 9,000 horse-power and 17 knots speed; the "Iowa," for 11,000 horse-power and 16.5 knots; the "Texas," for 8,000 horse-power and 17 knots

speed. At the time of the Santiago engagement, these ships were good for from 15 to 15½ knots with clean bottoms, and the total horse-power of the fleet was about 50,000. When we come to consider the Atlantic fleet, there is a marked increase in speed and power. The five ships of the "Connecticut" class, designed for 16,500 horse-power and 18 knots, developed, on trial, from 19,000 to 20,000 horse-power, and speeds of from 18.3 to 18.8 knots. The five ships of the "Virginia" class developed from 20,000 to 24,500 horse-power, and all steamed at over 19 knots on trial. The "Maine" and "Missouri" made over 18½ knots for 16,000 horse-power; the "Illinois" and "Wisconsin," 16.2 and 17.2 knots for 11,000 and 12,300 horse-power; and the "Kearsarge" and "Kentucky" made 16.8 and 16.9 knots with 11,788 and 12,179 horse-power. The total horse-power of the whole fleet, as developed on trial, was 258,000, as against 50,000 developed on trial by the Santiago fleet. This is an increase of 500 per cent in power. There is no corresponding increase in the cruising speed of the fleet as a whole, since it is governed by the speed of the slower ships of the "Alabama" and "Kearsarge" class, whose sea speed is probably not much better than that of the Santiago fleet. The ten ships of the "Connecticut" and "Virginia" class, however, have a sea speed two to three knots greater.

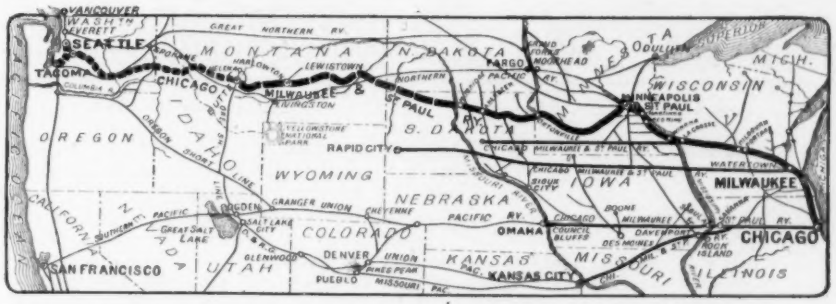
In a comparison of the crews of the two fleets, there is the same increase of from 450 to 500 per cent. The total number of officers and men in the Santiago fleet, if they contained the regular complement, was 2,276, and in the battleships of the Atlantic fleet, it is about 10,237. It is probable, however, that the crews were temporarily increased during the Spanish-American war, and we know that large numbers of extra men were carried on the cruise around the world.

Equally impressive are the two diagrams in the accompanying drawing, showing the relative power in the number of heavy armor-piercing guns of 12- and 13-inch bore. In the Santiago fleet there were mounted twelve 13-inch guns and six 12-inch. The Atlantic fleet mounted altogether sixty-four 12-inch guns. It should be noted, however, that the above comparison is based merely upon numbers, and takes no account of the enormous increase, both in the rapidity of fire, and in the striking energy of each projectile as it left the gun. To get an accurate idea of the comparative weight of metal thrown by the two fleets in a given time, we must turn to the diagram showing, by the outlines of the two projectiles, the comparative amount of metal which could be thrown from the broadsides of the two fleets, during five minutes of an engagement. The enormous difference is explained by the fact that improved methods of mounting the guns, improved ammunition hoists, breech mechanism, rammers, etc., have increased the rapidity of fire about five times, so that for every single shot delivered from a 12-inch gun in 1898, the crew of a 12-inch gun on the Atlantic fleet can deliver five shots. There has been a similar increase in the rapidity of the smaller guns, and the result is shown in the total metal delivered, which in five minutes' firing by the Santiago fleet would amount to only 69,140 pounds, as against 1,401,680 pounds, which could be delivered in the same time from the broadsides of the Atlantic fleet, an increase of 2,000 per cent.

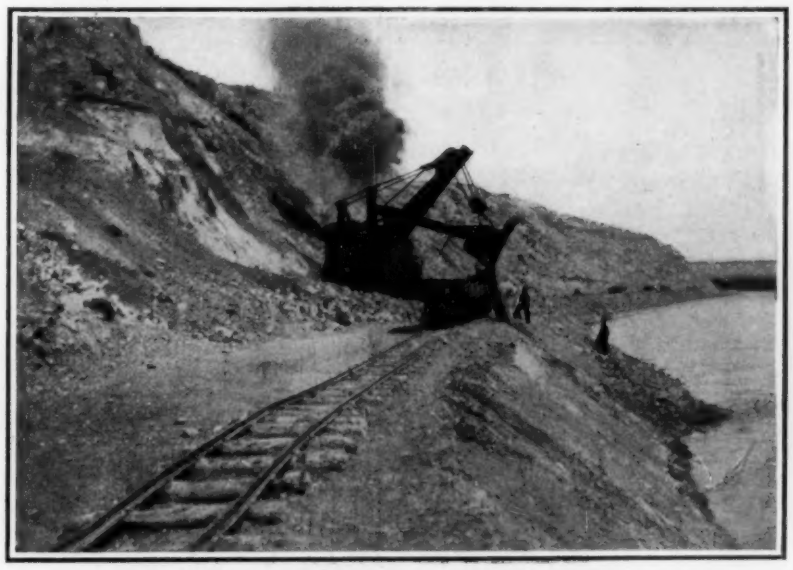
But this is not all; for not only has there been an increase in the rapidity of fire, but the energy of a given weight of metal thrown has also been greatly increased. In the intervening ten years there has been a great improvement both in the powder and the guns. The old brown powder has given way to smokeless powder, and the length of the guns has been increased from 30 and 35 calibers to 40 and 45. The smokeless powder, giving off greater volumes of gas, exerts its accelerating pressure upon the base of the projectile through a greater length of bore, and the energy imparted, which varies as the square of the velocity, has risen, in the case of the 12-inch gun, from 25,985 foot-tons to 44,000 foot-tons. Applying these results to the two fleets, we find that in five minutes' firing with all guns on one broadside, the metal delivered by the Santiago fleet would have a total energy of 2,146,738 foot-tons, whereas the total energy of five minutes' broadside from the Atlantic fleet would be over thirty times as great, or 66,328,910 foot-tons.

But it is not the amount of metal that leaves the muzzles of the guns that determines the issue of a sea fight, but rather the amount of it that lands on the enemy—"it is the hits that count." Therefore, we will now substitute two individual ships for the two fleets, and compare the actual ability to inflict damage on the enemy of the "Oregon" of 1898 and the flagship "Connecticut" of 1908. The "Oregon" in five minutes' firing from all the guns which she could train on one broadside was capable of hurling at the enemy 15,800 pounds of metal. In the same time the "Connecticut," from her 12-, 8-, 7-, and 3-inch guns could deliver 89,200 pounds of metal. After the battle of Santiago our ordnance officers made a count of the number of hits on the sunken Spanish ships. Comparing this with the number of shots fired, which, of course, was known for each of our vessels, it was found that only two per cent got home on the enemy. It is generally believed, however, that more hits than this were made. Many of the shot holes being below water could not be counted; many shots must have entered previous shot holes; and additional hits were probably made upon portions of the vessel which were subsequently blown bodily away. Let us then assume that the average of hits at Santiago was five per cent, as shown in the accompanying left-hand diagram representing a modern battleship. In our latest target practice, conducted as nearly as possible under battle conditions, the average efficiency of the ships of the Atlantic fleet is sixty per cent of hits. But in an actual engagement the shells of the enemy would be getting home upon our own ships, and therefore, to a certain extent, disturbing the aim of our gunners. On the other hand, there would be no smoke, as at Santiago, to hide the enemy. We have therefore cut down the average to forty, and represented in the right-hand drawing the same modern battleship as she would appear after the first five minutes of an engagement with the "Connecticut." Applying this comparison of accuracy to the diagram showing by the size of the ships the relative amount of metal thrown, we find that the "Connecticut" from being over five and a half times as large must be represented, as in the lowest diagram, by a ship forty-five times as large as the "Oregon"; or, to put it in other words, the "Connecticut," during a five minutes' engagement with the "Oregon," would land forty-five times as much metal on the "Oregon" as the "Oregon" would land on the "Connecticut." Furthermore, this preponderance is yet further increased by the fact that the relative energy of this metal, as thrown, is, shell for shell, from 30 to 40 per cent greater in the case of the "Connecticut."

This brings us face to face with the astonishing fact that the "Connecticut" of 1908 would be probably more than a match for the whole Santiago fleet of 1898. Having an advantage of three knots in speed and of the greater range and accuracy of her high-velocity guns, she could maintain a position beyond the effective hitting range of the older ships, and cripple or sink them in detail.



Map showing the extension of the Chicago, Milwaukee & St. Paul Railway from the Missouri to the Pacific coast.



Steam shovel work at Lock Bluffs, Montana.

THE EXTENSION OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY TO THE PACIFIC COAST.

THE EXTENSION OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY TO THE PACIFIC COAST.

With the completion to the Pacific coast in the near future of the extension of the Chicago, Milwaukee & St. Paul Railway (now known as the Chicago, Milwaukee & Puget Sound Railway) one more of the great railroad systems of the West will be entitled to rank as a transcontinental line. For the beginnings of this great railway system we must go back to the year 1865, when the Minnesota Central, now known as the Iowa and Minnesota Division of the Chicago, Milwaukee & St. Paul Railway, was completed to Faribault, Minn. This road reached the Iowa line in 1866, and was completed to St. Paul in 1867. Since that time the growth of the system has been rapid, the total mileage reaching 4,721 miles in 1884, 6,065 miles in 1892, 6,382 miles in 1903, 7,264 miles in 1907, and 7,451 miles in 1908. The total length of the extension now being completed from the Missouri River to the coast is 1,400 miles, and by the time it is opened the total mileage of the whole system will have reached 9,000 miles.

It is probable that by the time of its completion the new line will have created a record for rapidity of construction. Work was begun in April, 1906, and if the expectations of the engineers and contractors are fulfilled, the last main line rail will be laid by April 1, 1909, and the whole stretch of 1,400 miles will have been built in the remarkably short time of three years. During this period 60,000,000 cubic yards of material will have been excavated, 360,000 yards of tunnel driven, 20 miles of bridges erected, and 200,000 tons of 85-pound rails laid, at a total cost of $85,000,000.

The new line being the latest of the transcontinental roads to be built, has all the advantages which come from accumulated experience in the construction of similar roads that have already been built. From the standpoint of operation, the most important question is that of grades, and particularly what is known as the "ruling grade," this last being the maximum degree of grade occurring on any given stretch of the line. No matter how short its extent may be, the ruling grade determines the total weight of train which can be hauled over the division upon which the ruling grade obtains. If a short stretch of only a quarter of a mile of two per cent grade occurs on a division of say 100 miles, where there is no stretch of grade exceeding say 0.5 per cent, the maximum train-load must be reduced on that division to the maximum which an engine can haul unassisted over the short stretch of two per cent grade, or additional pusher engines must be maintained at the ruling grade to assist the trains over this quarter of a mile of track. The new line, however, is characterized by favorable gradients and easy curvature. Between the Missouri River and Marmarth, N. D., the ruling grade east-bound is 0.5 per cent, and between Marmarth, N. D., and Melstone, Mont., a distance of 235 miles, it is 0.4 per cent. From Melstone, Mont., to Harlowton, Mont., 104 miles, there is no adverse east-bound grade; the entire distance being a very gradual descent conforming to the valley of the Musselshell River. The maximum grade of the Montana Railroad, when revised, will be one per cent. Between Lombard, Mont., and Piedmont, Mont., the maximum east-bound grade is 0.3 per cent, and between Piedmont and Butte, crossing the continental divide, the ruling grade is 1.66 per

Laying track on the Chicago, Milwaukee & Puget Sound Railway.

Tunnel near the summit of one of the mountain passes.

cent, compensated, as in all other instances, for curvature.

Between Butte and the Bitter Root Mountains the line follows the Deer Lodge, Hell Gate, and Missoula rivers, and the ruling east-bound grade is 0.4 per cent, except between Deer Lodge and Butte, where it is 0.6 per cent. The Bitter Root Mountains are crossed with a maximum grade of 1.7 per cent, and from there to the Columbia River the maximum of 0.4 per cent is maintained. Johnson Creek summit, about 20 miles west of the Columbia River, is crossed with a maximum east-bound grade of 1.5 per cent, and the Cascades will be crossed with a maximum of 1.7. On the approach to the Cascades from Puget Sound the maximum grade is 0.8 per cent.

The new line begins at the town of Mobridge in South Dakota, and crosses the Missouri at a point about 100 miles due west of Aberdeen by a handsome steel bridge, which forms the subject of one of our illustrations. It is carried upon four concrete and stone piers, the foundations for three of which were put in by the pneumatic caisson process. Pier No. 3 was sunk to a depth of 90 feet 6 inches below low water. The bridge consists of a steel through-truss span of 128 feet on the east approach, followed by three steel through-truss spans each 423 feet 4 inches in length, which form the main bridge. The west approach consists of 281 feet of steel viaduct and 1,289 feet of timber trestle. The filling of the timber trestle will be completed this season. After crossing the Missouri the line parallels the State line through the Standing Rock Indian Reservation, and swings into North Dakota, touching several small towns, including Marmarthon on the Little Missouri River, where one of the division points will be established. Thence, it proceeds to Terry, Mont., on the Yellowstone River, and 4 miles to the west of Terry it crosses the Northern Pacific by an overhead bridge, and follows the line of the Yellowstone River to Miles City, Mont., where large division terminals are being built. The road passes through the valley of the Musselshell River, and at Harlowton joins the Montana Railroad, on which a large amount of work has been done in the way of reducing grades and curvature to accommodate the expected heavy traffic. At Lombard the new line again crosses the Northern Pacific Railway, and then climbs the great continental divide between Piedmont on the eastern side of the Rockies and the city of Butte on the west. At an elevation of 6,350 feet, the road pierces the mountains at the head of Pipestone Pass. The summit work includes two tunnels respectively 2,268 and 1,148 feet in length, and three steel trestles over ravines from 100 to 160 feet deep and from 400 to 600 feet wide.

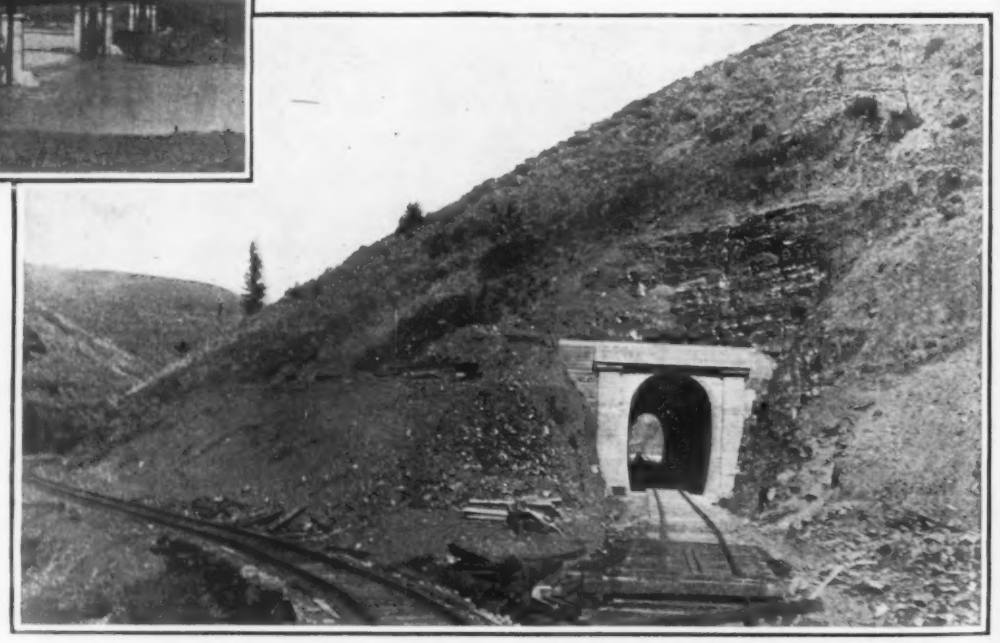
From Butte the road will pass by way of the broad and fertile Deer Lodge valley to Garrison and Missoula, Mont., and at Hangan, Mont., will commence the long climb over the Bitter Root Mountain range. At the summit it will pass through a tunnel 8,751 feet in length, and after crossing St. Paul Pass at an elevation of 4,160 feet it will pass through the famous

(Continued on page 156.)

View showing the remarkable development of the grades through the mountains west of the St. Paul Pass tunnel.

The three 423-foot spans of the Missouri River bridge.

A 200-pound keg blast at the Lock Buttes.



Relocation; the new line through the tunnel takes the place of the longer line around the hill.

THE EXTENSION OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY TO THE PACIFIC COAST.

CARNEGIE INSTITUTION MAGNETIC SURVEY OF THE WORLD.

History tells us that when Columbus made his memorable western voyage, his sailors mutinied because among other things the needle of the compass no longer pointed to the North Star; which showed that this phenomenon was observed but not understood. Since then all mariners have had to make allowance for the variations of the compass; for while in one part of the ocean the needle practically points due north, in other localities the variation, as the mariner terms the angle of departure of the compass from true north, is several degrees. Off the coast of Oregon and Washington there is a variation as high as twenty to twenty-five degrees. This variation does not exist only on the oceans, but is also found on land.

At present in the United States the line of no variation along which the needle points "true to the pole," or due north, begins in the eastern part of Lake Superior and Michigan and runs through Ohio about half way between Cincinnati and Columbus, and after passing through the eastern parts of Kentucky and Tennessee, cuts through South Carolina and enters the Atlantic Ocean near Beaufort. On the east side of this line the variation of the needle is west and on the west side the variation is east, and as a rule the further a place is from this line in our country the greater is the variation. In the northwestern part of Maine the compass points 21 deg. west of north and at Vancouver it points 25 deg. east of north.

The position of the line of no variation, as given, is that assigned to it on the magnetic charts issued by the United States Coast and Geodetic Survey. This line has for many years been moving southwestward. How long this motion will continue scientists do not know. The true north pole and the magnetic north pole are not identical. The true north pole is stationary, except for the very small motion recently discovered by astronomers; but the magnetic pole appears subject to considerable motion with the lapse of time, the actual path being as yet unknown, because of lack of data covering a sufficient period of time.

Humboldt recognized the importance of terrestrial magnetism and suggested that four times in every century an expedition of three ships should be sent out to examine as nearly as possible the state of the magnetism of the earth. This plan has never been adopted and the surveys that have been made have been more or less incomplete. Some notable surveys have been made, but all the work done has covered hardly more than one-tenth of the navigable waters of the earth. The most notable contributions to our knowledge were those made by Sir James Clarke Ross (1839-45) in connection with his memorable Antarctic expedition, and the data gathered by the "Challenger" expedition (1872-76) regarding the magnetic conditions along the paths traversed by the ship.

About four years ago the Carnegie Institution of Washington undertook to make series of systematic surveys. A department of research in terrestrial magnetism was organized and the work placed in charge of Dr. L. A. Bauer, who was formerly in charge of the magnetic survey of the United States under the Coast and Geodetic Survey. The first step in the ocean work was to make a survey of the Pacific Ocean, where until then little had been done except shore observations on some of the islands along the coast since the notable voyages of the "Challenger" and the "Gazelle," more than thirty years ago.

Observations were made from the converted wooden yacht "Galilee" which between August 1st, 1905, and May 31st, 1908, made three successive voyages in the Pacific tracing the great circle route, zigzagging in and out of the islands and covering with a network of tracks all the places left uncovered by the "Challenger." The "Galilee" cruised more than 60,000 miles. The most northerly point visited by the "Galilee" was Sitka, Alaska, and the most southerly Lyttleton, New Zealand.

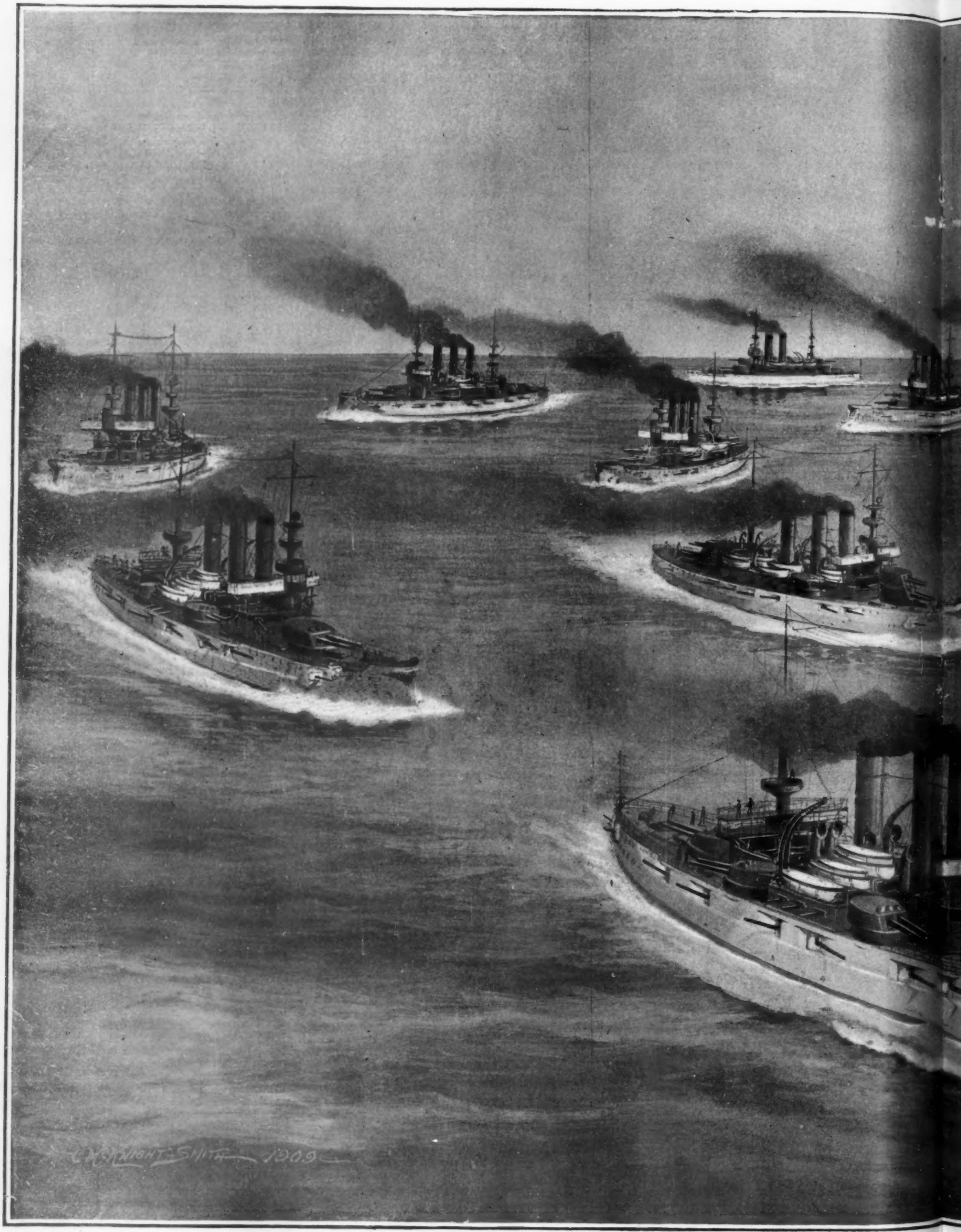
This was only the beginning of the work. The Institute has already made observations in many parts of the world and now has two expeditions in Africa, has just sent another to China, has one in Persia and Asia Minor, and has covered a part of South and Central America and British North America and Greenland. It is estimated that a magnetic survey of the world can be completed in about ten years more.

This interesting vessel is being built for the Carnegie Institution at Washington. Her survey of the oceans will form part of a comprehensive survey of the whole world, on land and sea, by which the magnetic variation of the compass is to be determined. No iron, steel, or other magnetic material will be used in her construction.

NON-MAGNETIC VESSEL FOR MAKING A MAGNETIC SURVEY OF THE OCEAN.

For the purpose of making systematic surveys to determine the magnetic conditions on all the deep-water seas of the world, the Carnegie Institution is having constructed a magnetic survey vessel, which has been specially designed for this work by Henry J. Gielow, the designer of some of our most successful racing yachts, to whom we are indebted for the following details of her design and construction: The ship is entirely original, being the first of her kind to be constructed. In order to render her practically non-magnetic, no magnetic metals, such as iron and steel, have been allowed to enter into her construction. The only magnetic material used is the thin, cast-iron liners of the cylinders of the internal-combustion engine with which she is fitted. Outside of the liners and the steel cams for the valves this engine is constructed entirely of bronze. As she is built for ocean surveys, the vessel is constructed in a particularly substantial manner, and combines with the strength of a merchant vessel all the beauty of finish and workmanship of a yacht. Her dimensions are: Length over all, 155 feet 6 inches; length on load waterline, 128 feet 4 inches; molded beam, 33 feet; depth of hold, 12 feet 9 inches; draft, 12 feet 7 inches; displacement, with all stores and equipment on board, 568 tons. She will have full sail power, with a brigantine rig carrying about 12,900 square feet of plain sail. The lines of the hull are fair and easy, and indicate both power and seagoing qualities throughout. The keel, stem, stern post, frames, and deadwood will be of white oak, the deck beams, planking, and ceiling of yellow pine, and the deck of Oregon pine. The fastenings will consist of locust treenails, copper and Tobin bronze bolts, and composition spikes. All through bolts will be riveted over rings both inside and outside. All metal deck fittings, metal work on spars and rigging will be of bronze, copper, and gun metal. The six-cylinder, internal-combustion engine is for the purpose of maneuvering the vessel when in port or crowded roadsteads, or during a calm at sea. It is capable of developing 125 indicated horse-power at 350 revolutions per minute, which, driving a feathering propeller of special design, will give the vessel a speed of six knots in calm weather. The shaft will be of Tobin bronze and the propeller and its feathering gear will be of manganese bronze. The engine will be operated by gas generated in a producer gas plant having a capacity to gasify 130 pounds of anthracite pea coal per hour, producing a fixed, well cleaned gas, containing 80 per cent of the heat units possessed by the coal. The vessel will carry twenty-five tons of coal in her bunkers, which will give her a cruising radius of 2,000 miles at a speed of six knots.

The living quarters for the officers, crew, and scientific staff are all below the main deck; and, for safety, the vessel will be subdivided into seven watertight compartments. The crew will be berthed forward in the forecastle. Then will follow the officers' messroom and staterooms. Abaft the officers' quarters are the accommodations for the scientific staff, from which a mahogany stairway will lead to the observation room on deck. By reference to our engraving, it will be noted that this observation room is located amidships between the foremast and mainmast. It consists of a central observation room, 14 feet 6 inches in length by 16 feet in width, which will be provided with the necessary desks, drawers, and tables, etc., for the work of the staff, and at each end of this room will be a circular observatory, 7 feet 6 inches in diameter, each of which will be fitted with a revolving dome constructed of bronze framework and plate glass. These two domes are shown in our engraving on a level with the deck of the observation room, and immediately forward and aft of the same. The construction of this exceedingly interesting craft is now proceeding at Tebo's yacht basin, Brooklyn.



Vermont, 16,000 tons; 18.8 knots.
Louisiana, 16,000 tons; 18.8 knots.
Minnesota, 16,000 tons; 18.8 knots.
Kearsarge, 11,520 tons; 16.8 knots.
Rhode Island, 14,948 tons; 19.0 knots.
Georgia, 14,948 tons; 18 knots
Virginia, 14,948 tons; 19.0 knots.

ATLANTIC FLEET RETURNING TO HAMPTON ROADS AT T

Missouri, 12,500 tons; 18.2 knots.
Nebraska, 14,948 tons; 19.1 knots.
Kentucky, 11,520 tons; 16.9 knots.
Ohio, 12,500 tons; 17.8 knots.
Connecticut, 16,000 tons; 18.8 knots.
Wisconsin, 11,552 tons; 17.2 knots.
Kansas, 16,000 tons; 18.1 knots.
Illinois, 11,552 tons; 17.5 knots.
New Jersey, 14,948 tons; 19.2 knots.

E CLOSE OF ITS 42,000-MILE TRIP AROUND THE WORLD.

Copyright 1909 by Munn & Co.

COMPOSITION OF THE FLEET WHICH SAILED AROUND THE WORLD.

Whether by design or accident, the fleet of battleships which was selected for the 42,000-mile cruise around the world, contained two or more representatives of every class of battleship which has been built for our navy from the close of the Spanish war to the present time. Moreover, it does not include a single ship that was in commission during that war, or took any part in its active operations. So that to any student of naval affairs (and there must have been many a score of such at the various ports of call) the visit of the fleet presented an unrivaled opportunity to trace the development of the United States navy, at least as far as its capital ships are concerned, during this, the most active decade of construction in the history of our navy.

During the progress of the war, when we had but four first-class and one second-class battleships in commission, frantic efforts were being made to rush to completion two sister ships, which, about the time of the outbreak of hostilities, had been launched from adjoining slips in the Newport News yard. These were the two battleships "Kentucky" and "Kearsarge," vessels of 11,520 tons displacement and a little less than 17 knots speed. They are characterized by a low freeboard of 13 feet, and by the fact that they mount their main battery of four 13-inch and four 8-inch guns in superposed, or two-deck, turrets, a device which has the distinction of having been installed against the bitter opposition of the naval constructors, and of being to-day cordially disliked by the line officers to whom its design and installation was originally due. Designed with the object of securing a maximum all-round fire for a maximum number of guns, it is open to the objections that too many guns are carried upon a single turntable, preventing independence of training; that there is an undesirable concentration of heavy weights; that the matter of ammunition supply is complicated; and that a single high-explosive, heavy armor-piercing shell might at one blow put half of the main armament out of commission. However, the superposed turret makes a brave show, and it cannot be denied that excellent target results have been achieved by guns mounted in this way.

The next two ships in point of importance in the fleet are the "Illinois" and "Wisconsin," of the "Alabama" class, vessels of about the same displacement and speed as the foregoing, and carrying four 13-inch guns in two 2-gun turrets, fore and aft, and a broadside of fourteen 6-inch rapid-fire guns disposed behind the armor of a central box battery. Ships of this class are easily recognized by their two elliptical smokestacks, placed abreast of each other, in the English fashion of the period when the "Alabama" class was designed. Their seagoing qualities, as compared with the "Kentucky" and "Kearsarge," are improved by the addition of a forecastle deck, giving a freeboard forward of between 19 and 20 feet on normal displacement.

Next in importance are the "Ohio" and "Missouri" of the "Maine" class. Originally, the three ships of this class were designed to be of the same size as the preceding "Alabama" class; but they were subsequently lengthened 20 feet, the displacement being raised to 12,500 tons, and the speed from 17 to 18 knots. The 13-inch gun gives place to a 40-caliber, 12-inch piece, of higher velocity and greater power. Four of these guns are carried in two turrets, and there is a powerful secondary battery of sixteen 50-caliber 6-inch guns. In the five ships of the "Virginia" class, a great advance was made both in size and power over the "Maine" class. The superposed turret was reintroduced, as was also the 8-inch gun. The ships are of slightly under 15,000 tons displacement, and all of them, on trial, made over 19 knots an hour. The armament is unusually powerful. It consists of four 40-caliber 12-inch guns, eight 40-caliber 8-inch, twelve 50-caliber 6-inch, and twelve 50-caliber 3-inch guns. The four 12-inch and four of the 8-inch are carried in two superposed turrets forward and aft, and the other four 8-inch are mounted in two turrets, one on each beam. The twelve 6-inch pieces are mounted behind casemates on the main deck. These five ships were the first battleships in our navy to have a continuous, unbroken upper deck from stem to stern, with a freeboard of 19 feet or over. Because of the superposed turret mounting, the "Virginias" possess a heavier broadside, even, than the "Connecticut" class which followed them, the total amount of metal that can be thrown from one broadside in five minutes being 98,800 pounds, as against 89,200 pounds for the "Connecticut" class.

In the "Connecticut" class our designers have turned out one of the most successful battleships designed for any navy. They are about 1,000 tons larger, though about one knot slower than the "Virginia" class. The main battery consists of four 45-caliber 12-inch guns mounted in two turrets; four 45-caliber 8-inch in four turrets; twelve 50-caliber 7-inch guns mounted in casemates on the main deck; and twenty 50-caliber 3-inch guns. The "Connecticut" represents the highest development of what might be called the mixed-caliber battleship, as distinct from the all-big-gun type, which was introduced by the "Dreadnought." As such, she is comparable with the "King Edward" of the British navy, which carries four 9.2-inch guns in her intermediate battery, as against the eight 8-inch guns of the "Connecticut."

All the ships of the fleet are heavily armored, the older vessels carrying from 16½ to 13 inches of Harveyized armor, and the latest ships from 11 to 6 inches of Krupp armor on the waterline and upon the principal gun positions. There has been a steady increase in coal-carrying capacity and, therefore, in the steaming radius, the bunker capacity being as follows: "Kearsarge," 1,500 tons; "Illinois," 1,275 tons; "Missouri," 1,825 tons; "Virginia," 1,900 tons; and "Connecticut," 2,275 tons. The complement has grown from 586 men in the "Kearsarge" to 916 in the "Connecticut."

It is interesting also to compare the steady increase in the amount of metal which can be thrown from a single broadside in the successive ships, the figures for five minutes continuous firing of all guns being as follows: "Kearsarge," 70,720 pounds; the "Illinois," 74,970 pounds; the "Missouri," 85,150 pounds; the "Virginia," 98,800 pounds; and the "Connecticut," 89,200 pounds. The great improvement in rates of fire and energies of projectiles, in the later guns, shows clearly in a comparison of the relative energy, the total energy of discharge for one broadside for the ships of each class in the Atlantic fleet being as follows: "Kearsarge," 2,035,520 foot-tons; "Illinois," 2,354,490 foot-tons; "Missouri," 4,490,670 foot-tons; "Virginia," 5,191,370 foot-tons; and "Connecticut," 4,522,140 foot-tons. It might be supposed that the "Connecticut," with her 45-caliber 8's and 12's and her 50-caliber 7's, would show a more powerful total muzzle energy than the "Virginia," with her 40-caliber 8's and 12's and 50-caliber 6's. But the "Virginia" can concentrate two more 8's upon the broadside, and the greater rapidity of fire of her 6-inch guns more than offsets the greater energy of the slower-firing 7-inch piece; the total energy for five minutes of the 7-inch battery being 1,508,810 foot-tons, and of the 6-inch battery, 2,057,040 foot-tons. In the same way, the eight 6-inch guns of the "Maine" account for 2,742,720 foot-tons of her total energy.

If, however, we take account of the "remaining energies," which determine the punishing power of the guns at the fighting ranges of from 6,000 to 8,000 yards, the "Connecticut" heads the list by a good margin, and the "Maine" drops far behind.

The total muzzle energy of the whole fleet's broadsides during five minutes engagement would be 66,328,910 foot-tons. This would be sufficient to raise the battleship "Kentucky" over one mile into the air.

THE EXTENSION OF THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY TO THE PACIFIC COAST.

(*Continued from page 152.*)

Coeur d'Alene district. At Beverly, Wash., the line reaches the Columbia River. The last stretch of the new road passes through the virgin timber lands of Snoqualmie Pass in the Cascade Mountains, which are probably the richest timber lands in the State of Washington; and then after following the Cedar River valley to Maple valley, it runs into the populous and thriving cities of Seattle and Tacoma on the Pacific coast. The line to Tacoma runs through Kent and Auburn, passes through Sumner and North Puyallup, crossing the river of that name, and then entering the famous seaport of Tacoma.

Although for a considerable portion of its distance the new line traverses approximately the same country as the Northern Pacific, for the greater part of the distance it will open entirely new sections, in which are included some large areas of fertile agricultural country, and extensive districts that are rich in mineral and forest wealth. The new line will have an advantage over the present lines to North Pacific coast points in lower grades and shorter mileage. The development of the country through which it passes, and the carriage of freight and passengers to and from the large areas which will be tributaries to the line, are not by any means the sole objects for which it has been built. Its promoters are looking beyond the broad Pacific, in the expectation of sharing that large and ever-accumulating trade, which has already assumed considerable proportions, between the Orient and the leading ports of the Northwest. Traffic arrangements have already been made with certain lines of steamers to operate in connection with the new transcontinental route.

According to a consular report, Sir Oliver Lodge has recently demonstrated the efficiency of his fog-clearing apparatus in Liverpool. He succeeded in clearing a thick fog over a radius of 60 feet. The Lodge system consists in discharging electricity at high voltage from a series of disks, with the result that the fog is condensed and falls to the ground. The apparatus will soon be tested in London.

Correspondence.

A SUGGESTION FOR INVENTORS.

To the Editor of the Scientific American:

Regarding all of the information that has been published about the collision in the sinking of the steamship "Republic," there is one comment from a passenger of the "Florida" which is, I believe, of particular interest. It is as follows:

"As I got to the deck," said Roberto, "I saw the big hull of the 'Republic' a faint blur in the darkness, and immediately there came over the water the boom of a rocket, and the darkness was for a second illuminated. The bow of the 'Florida' was in bad condition, and there was a running and scurrying of men down there, investigating the nature of the damage and repairing it as best they could."

The question arises that if as soon as the distress rockets were sent off they illumined the ocean sufficiently to make out the whereabouts of the "Republic," why would it not have been a good plan to send off rockets before the collision? This, of course, brings up the entire question of what kind of lights, if any, will penetrate or illuminate in a fog.

Palmer H. Langdon.

New York, February 6, 1909.

A YACHT DESIGNER'S OPINION OF THE NAVY SITUATION

To the Editor of the Scientific American:

To your editorial in the Scientific American of December 19, 1908, commenting on President Roosevelt's recommendations in regard to the reorganization of the navy's bureaus, kindly accept, from one who has helped a little to make his country's navy the "best ever," a modest but sincere and hearty "encore."

Only by frequently repeating such clear and effective statements of the problems involved, can those who are entirely unfamiliar with them be shown the technical difficulties to overcome in the building of our naval vessels.

Your excellent illustration of the troubles that would result from an application of the general principle in the President's proposal to the question of a design for the defender of the "America's" cup, appeals strongly to one who has wrestled with the problems many years as a yacht designer.

As one who was moreover intimately connected with the design work on the ships under Lewis Nixon and the late J. J. Woodward, and more recently in constructing them under the eminent ex-Chief Constructor F. T. Bowles, allow me to second the expression of your hopes that our ships may continue to be designed by the technically expert.

Marblehead, Mass., December 21, 1908. J. R. P.

ALCOLINE.

To the Editor of the Scientific American:

Surely he who finds a short cut between an idea and its expression in this day, when railroads are spending millions in shortening and leveling their lines, is worthy of as much honor as Swift thought due the man who made two ears of corn grow where only one grew before. Now, it is patent to all that the appellation "denatured alcohol" cannot pass into current use. It is too long, clumsy, and contradictory for our monosyllabic age, and in its place I suggest the caption of this letter, *Alcoline*, and submit the following points in its favor:

First, it puts it into articulation with the other well-known fluid fuels: gasoline, kerosene, benzine, etc. The popular mind will very readily grasp the analogy, even if it should be etymologically incongruous.

Second, it would obviate or at least minimize the danger of such mistakes as have strewn the path of "wood alcohol" with twisted corpses. Possibly the world may not lose much by the departure of any chance boneheads who cannot understand that some kinds of alcohol kill more quickly than others, but some otherwise good and useful men might be tempted to try the new brand, "denatured alcohol," just as otherwise sensible people will dab at a freshly-painted surface, just to see if it is drying, so this point has some weight.

Third, it gives this substance, which is plainly destined to occupy an increasingly important place in our industries, a single, unconfusable name. "Denatured alcohol" is too long, confusing, and misleading. If it is "denatured," it no longer has a right to the name alcohol. To follow the analogy, the Scientific American is printed upon "denatured spruce" by type made of "denatured ore." The presses are operated by "denatured" lightning, which is generated by "denatured water" power, denatured by "denatured" forests of the Carboniferous era! Let us have a name as well as a place for everything, without qualifying words to trip us up!

Ward Morse.

Genoa, Nance County, Neb., January 6, 1909.

The Current Supplement.

The current Supplement, No. 1729, contains a large number of interesting contributions. Among these may be selected William H. Booth's paper on "Coal, Its Composition and Combustion," Friedrich Hartmann's instructive article on "Amalgams," a succinct statement of steam engine efficiency in the light of modern thermo-dynamic conceptions, an illustrated article on the government's efforts to stop the appalling loss of life in mines, a picturesque description of the wonderful cavern of Proumeyssac in France, an enumeration of recent earthquakes that preceded the great Italian cataclysm, a summary of the scientific attempts to stop bodily decay and prevent death, a review of some recent processes of making artificial unwoven cloth, an account of the surgical instruments of antiquity, a popular statement of the sewage problem, and a continuation of the treatise on aeronautic motors begun in the last number of the Supplement.

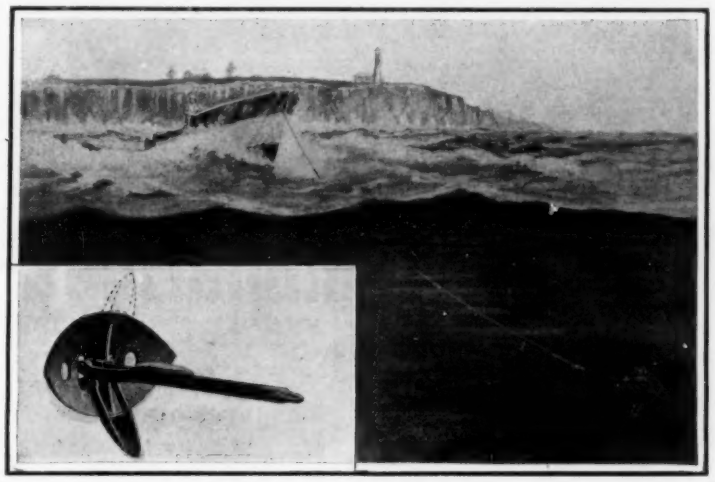
A COMBINATION ANCHOR.

So little real development has been made in anchors during the past few decades, that considerable interest attaches to the Hall combination anchor, the most important feature of which is the combination of a fluke anchor and a mushroom anchor. From the records of the Patent Office there appears never to have been a serious effort to accomplish this. The accompanying engraving of the anchor shows that it meets the most exacting demands of both of the former types.

It is a well-known fact, proved by years of universal experience, that for anchoring vessels where the bottom or holding ground is mud or very soft sand, the mushroom type of anchor excels any sort of fluke anchor. It is equally well known that, in bottoms of hard sand, rocks, or other hard material, the anchor with sharp prongs or flukes holds best. Theoretically, then, a vessel's safety would require that it be equipped with both types of anchor. But the mushroom is unwieldy in the extreme, difficult to stow aboard ship, and has therefore been universally discarded for portable use. It is, however, in general use as a permanent mooring. And as a properly made fluke anchor, either with one or two flukes, holds to some extent in soft bottoms, upon it has depended the safety of the vessel, regardless of the character of the bottom into which it is placed. Yet it is acknowledged to be eminently not adapted to hold in soft bottom. And even if a vessel were equipped with both types of anchor, the bottoms for which each is adapted merge into each other, through various degrees of hardness and softness, in which neither one could be depended upon for a secure hold. When the anchor is lowered and strikes the bottom, it falls so that the elliptical head rests on one of its broad sides, and the fluke on that side drops down of its own weight and drives its point into the bottom. As the mushroom is an elongated ellipse, it must always rest on one of its sides, and thus keep the plane of the flukes at right angles to the surface of the bottom, i. e., one fluke or the other must always engage the ground.

When the vessel's weight pulls the anchor forward, the fluke is driven deeper into the bottom until it reaches its maximum angle of 55 degrees with the shank, during which time the entire weight of the anchor, being concentrated at the mushroom end of the shank, drives it deeper. The edges of the mushroom are sharp, and the head itself is of such shape as to maintain the greatest possible hold on the bottom for each inch of penetration. Thus in soft bottoms the mushroom sustains an effective hold, which is augmented by the deeper hold of the fluke; while in bottoms too hard for the mushroom to penetrate, the fluke sustains a strong hold, which increases with the pull of the vessel, owing to its carefully studied shape and angle of penetration.

It has been proved, after exhaustive tests, that this type of anchor will hold more pounds of strain per pound weight of anchor than any simple type of anchor in any bottom.



A COMBINATION ANCHOR.

THE ITINERARY OF THE CRUISE.

The composition of the United States Atlantic fleet and the second torpedo flotilla, on their voyage from Hampton Roads to San Francisco, was as follows: The first division, under Rear Admiral R. D. Evans, commander in chief of the fleet, consisted of the four sister ships "Connecticut," "Kansas," "Vermont," and "Louisiana." The second division, Rear Admiral W. H. Emory commanding, consisted of the sister ships "Georgia," "New Jersey," "Rhode Island," and "Virginia." In the third division, under the command of Rear Admiral C. M. Thomas, were the "Minnesota," one of the "Connecticut class," and the sister ships "Ohio," "Missouri," and "Maine." In the fourth division, commanded by Rear Admiral C. S. Sperry, were the sister ships "Alabama" and "Illinois" and the sister ships "Kearsarge" and "Kentucky." Accompanying the fleet were four auxiliaries, the "Culgoa," "Glacier," "Panther," and "Yankton." In the torpedo flotilla were the destroyers "Whipple," "Truxtun," "Lawrence," "Stewart," "Hopkins," "Hull," and the storeship "Arethusa." Leaving Hampton Roads on December 16th, 1907, the fleet steamed to Trinidad, at which port it arrived December 23rd, after covering a distance of 1,803 miles. The next leg, one of the longest on the cruise, was from Trinidad to Rio Janeiro, a distance of 3,399 miles, the fleet leaving on December 29th, 1907, and reaching Rio January 12th, 1908. After a stay of nine days, a start was made on January 21st for Punta Arenas, 2,374 miles distant, which was reached February 1st, 1908. After navigating the Straits of Magellan in safety, the fleet entered the Pacific and turned north for the port of Callao, Peru, which it reached without incident after covering 2,838 miles. Callao was left on February 29th, and a stretch of 3,010 miles carried the fleet to Magdalena Bay, where it arrived on March 12th. Here, after a stay of one month, during which the fleet indulged in extensive target practice, the ships weighed anchor for the last leg of the course to San Francisco, 1,017 miles in length, and arrived in San Francisco Bay on May 6th, having covered a total distance of 14,441 miles since leaving Hampton Roads.

The torpedo flotilla followed the same general route, in shorter stages, making twelve calls between Hampton Roads and San Francisco, where it was timed to arrive on the same day as the battleship fleet.

Prior to leaving San Francisco, the Atlantic fleet was changed by the detachment of the second torpedo flotilla and the "Arethusa," and the substitution of the "Nebraska" and "Wisconsin" for the "Alabama" and "Maine," the two latter preceding the fleet to the United States *via* the Suez Canal. The fleet left San Francisco on July 7th, and after covering 2,100 miles reached Honolulu on July 16th, whence it sailed on July 22nd for the longest voyage of the whole cruise of 3,850 miles to Auckland, New Zealand, at which port it arrived on August 9th. Leaving Auckland after six days stay, the 1,284 miles to Sydney, Australia, were covered by August 20th; and after a stay of eight days the fleet sailed on August 28th on the shortest leg of the cruise, 575 miles, to Melbourne, Australia, which was reached on August 29th. Sailing again on September 5th, the fleet steamed to the westward for 1,350 miles to Albany, Australia, whence, after coaling, it sailed on September 18th for the Philippines, another long leg of 3,300 miles. The Philippines were reached on October 2nd, and on October 10th, a start was made for Yokohama, Japan, 1,750 miles distant, at which port the ships arrived October 17th. Here the fleet was divided, and on November 4th it set sail again for Manila, the second squadron going by way of Amoy, China. The first squadron reached Manila on October 31st, and the second squadron on November 7th. The total distance covered from San Francisco to Manila was 16,218 miles.

On December 1st, 1908, the fleet sailed for Colombo, Ceylon, 2,946 miles distant, which was reached December 14th, 1908; and on the 20th, it started upon another long leg of 3,440 miles to Suez, which was reached January 5th, 1909. With a view to visiting as many of the principal ports of the Mediterranean as possible, the ships scattered at Port Said, and Messina, Naples, Villefranche, Marseilles, Beirut, Smyrna, Malta, Tripoli, Athens, Salonica, and Algiers were visited; the fleet finally assembling at Gibraltar for the 3,200-mile voyage across the Atlantic Ocean to Hampton Roads.

MAP OF THE MEDITERRANEAN, SHOWING THE PORTS VISITED BY THE VARIOUS SHIPS AFTER THEY SCATTERED AT PORT SAID.

From a discussion on the subject before the Illuminating Engineers' Society it is noted that daylight commonly runs as low as one-tenth, or even one-hundredth of a candle-power to the square inch. Although it has been claimed that the injurious effects of artificial light were due to the ultra-violet contained therein, it was here pointed out that there is less ultra-violet light in the rays of various incandescent illuminants than there is in direct or reflected sunlight, so that the injurious effects of the artificial means are traced to the greater intrinsic brightness.

MAP SHOWING THE COURSE OF THE ATLANTIC FLEET ON ITS VOYAGE OF 42,000 MILES AROUND THE WORLD.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

CLEAT FOR ELECTRIC WIRING.—R. MCLENNAN, Ballston Spa, N. Y. This invention refers to certain improvements in cleats for electric wiring, and more particularly to cleats for securing a plurality of substantially parallel wires to a wall or ceiling at a bend or turn in the wires, as, for instance, at a corner of the room.

ELECTRIC SAFETY-RAZOR.—L. BRUNACCI, New York, N. Y. In this case the invention relates to safety razors, and the object is to produce a razor of simple construction having blades operated by electrical means, and shielded in such a way that they may be applied to the face without danger of cutting the skin.

Of Interest to Farmers.

MANUAL PLANTER.—S. A. SIERRA, Caracas, Venezuela. The device embodies a seed box, a discharge chute extending above the bottom of the box having an opening, and an elevator having a seed holder, means forcing the elevator downwardly and normally retaining the seed holder at the bottom of the box, and means for raising the elevator against the tension of the last-mentioned means to bring the holder into register with the opening and deliver the seed into the chute.

MACHINE FOR DIGGING ROOTS.—T. H. MALEY, Goodhue, Minn. One purpose of the invention is to provide a machine especially adapted for eradicating the roots of quack grass, by which the roots are dug, conducted to the rear of the machine, and are there acted upon by strippers and delivered into a receptacle supported upon the frame of the machine at the rear.

HUSKING ROLLER.—G. H. GEHRKING, Elk Mound, Wis. This invention pertains to corn husking and fodder shredding machines, and its object is to provide a pair of husking rollers, arranged to prevent crushing of the ear of corn, and to insure an easy gripping of the corn stalks, thus permitting of running the machine with a minimum expenditure of power.

Railways and Their Accessories.

TRACK-STRAIGHTENER.—M. E. LOEHR, Claypool, Ind. In view in this case is the combination of a cable, a member composed of two principal sections threaded together, one designed to be applied to a rail, the other to a cable, clamps for engaging the rail at opposite ends of the cable and having means for locking them to the rail when the cable is placed under tension, and oscillatory means operable in both directions of its movement to separate the sections of the member and force the rail and cable apart.

RAILROAD-TIE.—R. L. BOWER, Blandburg, Pa. The tie is formed of a sheet of metal rolled up into tubular form, and having overlapping portions on the top to render the tie exceedingly strong and to form firm seats for the rails, the tubular tie also having pairs of upwardly extending members for receiving and holding rail fasteners and for determining the seats for the rails and consequently the gage of the track.

Machines and Mechanical Devices.

WIRE TIER FOR BALING-MACHINES.—J. H. GREGORY and M. L. SIAS, Farwell, Mich. The aim in this invention is to avoid the necessity for using wire with a special head or loop, and to firmly secure together the plain overlapping ends of ordinary wire, the fastening operations being brought about by the movement of the material within the baling press.

PULP-SCREEN.—B. W. BOYD, Readsboro, Vt. In this instance the invention is an improvement in pulp screens of a simple and compact nature, adapted to effectively and rapidly separate the coarse product of pulp and such similar materials from the fine pulp and water by centrifugal action.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending February 9, 1909,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Adjustable handle, Stroud & Jordan 911,848
Adjustable wrench and tool, P. Tavernetti .. 911,629
Advertising device, C. D. Stoll 911,915
Advertising or display apparatus, automatic, H. M. Schutz 911,618
Air and other gases, apparatus for separating heavy particles from, W. J. Baldwin 911,802
Air brake apparatus, J. O. Dodge 911,953
Air brake system, G. Machoskie, Jr 912,269
Air brake system angle cock, S. H. Dunning 911,811
Air lift for deep well pumping, equalizing multiple, R. H. Elsey 911,649
Air ship, F. L. Orr 912,158
Alarm and telephone system, G. Babcock .. 911,565
Alloys, manufacturing, H. Kunel 912,246
Amusement apparatus, racing, M. Lehmann, et al 912,004
Amusement device, W. J. Manning 911,892
Anchor, land, J. H. McNutt 912,018
Anchor, rail, W. H. Walker 911,836
Animal trap, J. C. King 912,134
Animal trap, B. A. Swasey 912,203
Animal trap attachment, M. Gravatt 911,974
Automobile steering head, H. C. Stutz 911,777
Axle lubricator, L. E. Sherwood 911,910
Bag machine, J. F. Ames 911,563
Basket, collapsible floating, A. Lehmann ... 911,661
Bath cabinet, vapor, L. C. Jaques 911,727
Battery. See Storage battery.
Battery charging system, W. I. Thomson .. 911,859
Bed bottom, spring, E. A. Bedient 911,642
Bed, invalid, L. W. Ward 912,214
Bed, metal, J. M. Adams 911,862
Bed spring lifter, Hermann & Bostrom 911,980
Bedstead, H. A. Sears 912,036
Bedstead, H. T. Stevenson 912,200
Bell, switch, multiple call, L. I. Freas 911,968
Belt, conveyer, M. C. Graney 912,116
Belt perforating gage, A. Pullen 911,608
Belt replacer, J. Horinek 911,983
Belting, E. A. Usina 911,855
Binding post, J. W. Feerrer 912,237
Block signal, M. J. Feron 912,103
Boat, N. B. Broward 911,806
Boat propelling mechanism, J. T. Stafford. 912,198
Boat steering device, power, F. A. Warren, Jr. 912,215
Boiler, F. S. Snyder 911,685
Boiler feeder, J. P. Senter 911,768
Boilers, composition for preventing scale in, G. Wegener 911,928
Book binder, loose leaf, A. S. Haru 911,977
Book, manifolding, J. Kitchen, Jr 911,507
Book, sales, E. K. Bottle 911,865
Borax, making, G. E. Bailey 911,695
Boring machine, M. L. Andrew 911,659
Bottle filling machine, J. M. Falls 912,250
Bottle filling machinery, L. McCampbell 912,252
Bottle, non-refillable, H. Gehman 912,109
Bottle stopper, J. J. O'Grady 912,156
Box, E. L. Ansorge 911,635
Box for berries, etc., collapsible, O. C. Fenlason 912,101
Box for berries, etc., collapsible veneer, O. C. Fenlason 912,099, 912,100
Box for the display of articles contained therein, G. A. Durkee 912,094
Bread, making albuminous, G. Hess 911,722
Bread, making albuminous, O. Muller 911,745
Breaker and alarm, vacuum, B. W. Hill .. 912,243
Bridge, lift, E. Swensson 911,628
Bridle and throat latch snap, B. L. Miller. 912,014
Brooder, chicken, F. P. Huffman 911,990
Brush attachment, J. T. Hart 911,589
Brush mounting, bottle washer, A. N. Davis 912,085
Brush, shoe, J. H. Graffin 912,115
Bucket bail, W. B. Eason 912,095
Buckle, W. A. Meyer 911,895
Buckle, J. A. Alcorn 912,053
Buffing or polishing wheel, F. M. Levett .. 911,889
Bundle tie, Price & Richard 911,677
Button, shirt, C. R. Jacobs 911,889
Cabinet, C. B. Reese 912,168
Cabinet, sectional file, C. W. Pomeroy ... 912,166
Cake machine, C. G. Tucker 911,851
Cake mixer, C. W. Hottman 911,985
Calculating machine ribbon mechanism, A. Pentecost 912,162
Can opener, C. A. Wade 912,212
Candlestick, T. Gossack 912,113
Candle cutter, adjustable combination, J. Lindberg 912,006
Car buffer, G. P. Parton 912,160
Car corner anchor, H. E. Haddock 912,120
Car door, J. W. Ramsey 911,617
Car draft rigging, railway, S. B. Haseltine 911,874
Car dumping mechanism, cupola, J. Hyslop 911,725
Car folding stake, railway, J. W. Kendrick. 911,998
Car, passenger, H. Howson 911,987
Car stake, S. Haley 912,122
Car stake, railway, S. W. Murray 912,149
Car, tank, T. G. Phinny 911,607
Car ventilator, railway, J. E. Ward 911,689
Cars, friction brake to prevent side motion of, G. Hagberg 912,121
Carburetor, W. K. Andrew 911,692
Carburetor, C. Fox 911,967
Carburetor for internal combustion engines, W. A. Daley 912,083
Cards, etc., packaging playing, W. H. Dougherty 911,647
Carpet beater, A. F. Mewes 911,831
Cartridge, A. Wratzke 911,736
Cement applying machine, W. F. Lautenschlager 911,690
Cement building block, J. Crawford 912,080
Cement, hydraulic, Spencer & Eckel 912,266
Centrifugal machine, A. J. Ericsson 911,652
Ceramic material charger, C. Glelow 911,816
Chain straightening mechanism, B. T. Tompkins 912,208
Chain, tire, F. A. Fox 911,585
Chair, W. F. Wells 912,216
Chamfering and countersinking machine, C. F. Messinger 912,250
Character bars, making, D. W. Dodson, 911,955, 911,958
Character forming machine, D. W. Dodson, 911,954, 911,957
Check controlled game apparatus, J. Graves. 912,239
Checking and unchecking device, A. R. Ward 911,857
Cherry pitter, W. J. Mack 911,828
Chimney top, E. J. Cochran 912,076
Chopper. See Cotton chopper.
Churn cover, J. W. Jackson 911,819
Cigar box holder, B. L. Fowlkes 911,712
Cigar bunches, making, S. I. Prescott 911,756
Cigar cutter, A. W. Barton 911,804
Circuit closer, A. B. Culver 911,943
Cleaning knife, T. S. Moffett 912,146
Cleat, porcelain, E. Ball 911,864
Clevis, U. Desallier 912,089
Clevis, W. H. Livingston 912,143
Clock and coin freed winding apparatus, A. G. P. Wiingaard 912,220
Clock, electric, Engelberg & Wagner 912,235
Cloth transfer sheet, K. M. Kaye 911,594
Clothes drier, K. Erickson 911,651
Clutch device, W. H. Pike, Jr 912,165
Coaster brake, back pedaling, A. P. Morrow 911,835
Cock, automatically closing, A. O'Brien 912,022

The "Octopus" Type

Holland Submarines

Superiority over all other types attested by findings of **U. S. Navy Board** after extensive tests in May and June, 1907.

The Electric Boat Company

11 Pine St., New York, U. S. A.

THE INTER-POLE MOTOR FOR INDIVIDUAL DRIVE

It's the **lightest, most compact** of motors. Speed ratios up to 6 to 1, on **single voltage,** by **field control.**

Sparkless at **all loads** and **all speeds.**

Equally satisfactory in any position.

See the bulletins and learn the details.

Electro-Dynamic Co.

BAYONNE, N. J.

PHILADELPHIA, PA.
Arcade Building

PITTSBURCH, PA.
200 Ninth Street

Legal Notices

PATENTS

INVENTORS are invited to communicate with **Munn & Co., 361 Broadway, New York,** or **625 F Street, Washington, D. C.,** in regard to securing valid patent protection for their **inventions. Trade-Marks** and **Copyrights** registered. **Design Patents** and **Foreign Patents** secured.

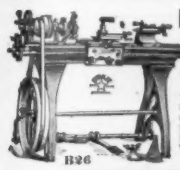
We undertake all **Patent, Trade-Mark** and **Copyright Practice,** both before the **Patent Office** and the **Courts,** and we have special facilities for handling **Infringement** and other suits in Federal and State jurisdictions.

A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing us with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our **Hand-Book** on Patents will be sent free on request.

Every patent secured through us receives special notice in the Scientific American.

Ours is the **Oldest** agency for securing patents; it was established over sixty years ago.

MUNN & CO., 361 Broadway, New York
Branch Office, 625 F St., Washington, D. C.



LABORATORY PRACTICE

demands delicate and accurate machinery. Nothing is more precise and efficient in their line than our **"Star" Screw-Cutting Lathes** which professional and amateur mechanics alike praise. At home and abroad they are admitted to be superior in work and construction. Ask for catalogue "B."

B26

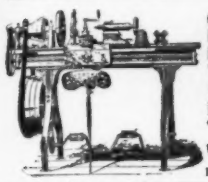
THE SENECA FALLS MFG. CO.
695 Water St., Seneca Falls, N.Y.

Engine and Foot Lathes

MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. BEST MATERIALS. BEST WORKMANSHIP. CATALOGUE FREE

SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

Foot and Power and Turret Lathes, Planers, Shapers, and Drill Presses.
SHEPARD LATHE CO., 123 W. 2d St. Cincinnati, O.



FOR **GUNSMITHS, TOOL MAKERS, EXPERIMENTAL & REPAIR WORK, ETC.**

From 9-in. to 13-in. swing. Arranged for Steam or Foot Power, Velocipede or Stand-up Treadle. *Send for Lathe Catalog.*

W. F. & JNO. BARNES CO.
Established 1872.
1999 Ruby St., ROCKFORD, ILL.

Palmer Motors

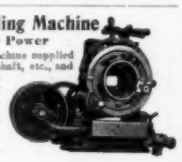
Two and Four Cycle. One, Two and Four Cylinder. Stationary and Marine. One to Twenty H. P. Catalogue FREE.

PALMER BROS., Cos Cob, Conn.

New York: 30 East 20th Street
Philadelphia: The Bourse
Boston: 85 Union Street
Portland, Me.: Portland Pier
Seattle, Wash.: Colman Dock
Vancouver, B. C.: 1600 Powell St.

Pipe Cutting and Threading Machine
For Either Hand or Power

This machine is the regular hand machine supplied with a power base, pinion, countershaft, etc., and can be worked as an ordinary power machine or taken from its base for use as a hand machine. Pipe ⅛ in. to 1½ in. diameter handled easily in small room. Illustrated catalogue—price list free on application.



THE CURTIS & CURTIS CO.
6 Garden St., Bridgeport, Conn.

"THE ONLY ONE"

Here is the only double lip, self-centering countersink having a cutting keen edge and made on the true principle for a wood-working tool. It clears itself of shavings in any kind of wood and cuts a smooth, round hole. Made from the best steel, forged, twisted and tempered. Can be sharpened from the inside without a file. Prices, ⅝ in., 35c.; ⅞ in., 40c.

Send for 232-page catalog No. 18-B.

THE L. S. STARRETT CO., Athol, Mass., U. S. A.

HOW TO MAKE AN ELECTRICAL Furnace for Amateur's Use.—The utilization of 110 volt electric circuits for small furnace work. By N. Monroe Hopkins. This valuable article is accompanied by detailed working drawings on a large scale, and the furnace can be made by any amateur who is versed in the use of tools. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1182. Price 10 cents. For sale by MUNN & Co., 361 Broadway, New York City, or by any bookseller or newsdealer.

AUTOMOBILE TRADE
DYKE'S COURSE, $10

FREE ILLUSTRATED PAMPHLET
SEND FOR IT TO-DAY. IT IS INSTRUCTIVE
AUTOMOBILE OWNERS SAVE REPAIR BILLS

This Course for you, your son, your chauffeur. We positively CAN teach all about the Gasoline Engine and Automobile by mail. Our Working Models are wonders; our 34 Charts, 34 lift. Charts and Dyke's New Book complete the course. A. L. DYKE, the first Auto Supply Man, prepared this course. Part of it comes from Europe.

DYKE'S Correspondence School of Motoring, ST. LOUIS

Do You USE GRINDSTONES?

If so we can supply you. All sizes **mounted** and **unmounted**, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. *Send for catalogue "1"*

The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

"Aeronautics" American Journal of Aerial Locomotion

Read the Enormous Progress in Flying Machines and Airships.

Nothing happens aeronautically anywhere in the world unrecorded in this magazine.

The Only Aero Journal in America. Third year. Send for sample copy.

1775 Broadway, New York

The Authority on the Subject

NEW EDITION. JUST PUBLISHED

Compressed Air

Its Production, Uses and Applications

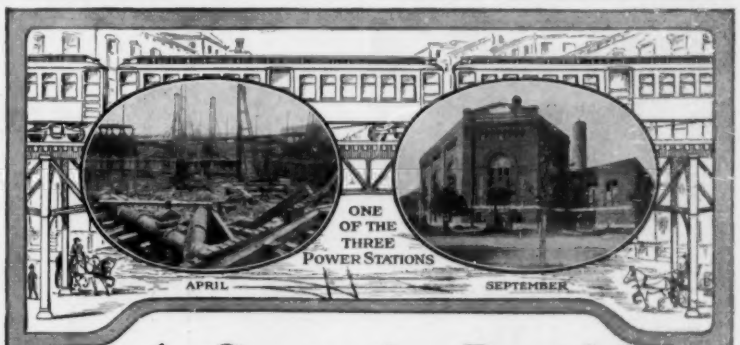
By GARDNER D. HISCOX, M.E.

Fifth Edition. Revised. Size 6¾ x 9½ inches. 665 pages. 540 illustrations. Price in cloth, $5.00 postpaid

A COMPLETE treatise on the subject of Compressed Air, comprising its physical and operative properties from a vacuum to its liquid form. Its thermodynamics, compression, transmission, expansion, and its uses for power purposes in engineering, mining and manufacturing work. Air compressors, air motors, air tools, air blasts for cleaning and painting. The sand blast, air lifts for pumping water, oils and acids, submarine work, aeration of water, railway appliances and propulsion. The air brake, pneumatic tube transmission, refrigeration and cold rooms. The hygiene of compressed air, its liquefaction and phenomena, including forty tables of the physical properties of air, its compression, expansion and volumes required for various kinds of work, and a list of patents on compressed air from 1875 to date. Taken as a whole it may be called an encyclopedia of compressed air. It is written by an expert, who has dealt with the subject in a comprehensive manner, no phase of it being omitted.

MUNN & COMPANY, Publishers
361 Broadway, New York

Cock, stop and waste, W. W. Watters	911,858
Cockeye, M. R. Johnson	912,132
Coffee roaster, A. Landry	912,136
Coffin box, J. A. Cook	912,078
Coining press, O. Smith	912,194
Collar, adjustable horse, H. A. Newby	911,749
Collar fastener, S. H. Tolman	911,630
Color whirling, W. R. Evans	911,582
Combustion furnace, smokeless, R. Stoker	912,201
Commutator construction, H. H. Ralston	911,758
Concrete buildings, framework for the construction of, W. W. Carpenter	912,070
Concrete mixer, W. E. Hassam	912,125
Concrete piles, method and apparatus for sinking, F. B. Gilbreth	911,971
Concrete shingle, E. P. Auger	912,057
Concrete structure, reinforced, L. White	912,219
Conduit rod, Upson & Dole	911,854
Connection, releasable, C. H. Dempsey	912,087
Contact maker, F. E. Kinsman	911,596
Controlling switch, G. H. Hill	912,128
Cooler and aspirator, J. D. Devoss	911,952
Cooling apparatus, H. J. Vasconcelles	911,785
Cooling apparatus, J. W. Jackson	911,879
Core compound, E. E. Howe	912,129
Corn rack, seed, W. Ulbrich	911,923
Cornet, S. Adkins	911,637
Cornet bell mute, C. G. Conn	911,940
Cotton and wool mixed goods, production of effects on, P. G. Jones	911,593
Cotton chopper, E. May	911,739
Cotton gin, C. Tuckfield	912,210
Coupling, T. W. Christian	911,645
Coupon or tag for cartons, J. A. Kyle	911,884
Crate, storage and shipping, G. Klenk	912,273
Creel, L. E. Palmer	911,804
Cultivator, J. Horinek	911,876
Curtain holding device, C. L. Hopkins	911,982
Curtain pole fixture, F. L. Lathrop	911,732
Cutting machine, flange, C. L. Finch	912,238
Cylinder relief and drainage device, F. C. Miller	911,603
Damper regulator, H. Walker	912,213
Dental brush, J. H. Abbott	912,051
Dental floss holder, J. P. Locke	911,604
Dental mirror and attachment therefor, A. J. Kleberg	911,659
Dental obtunder, atomizing, Cook & Hadley	911,646
Dental suction plate, C. R. Powers	912,026
Derrick, portable, W. C. Booz, reissue	12,915
Die, D. W. Dodson	911,956
Disappearing stand, Oldham & Kirk	911,821
Disks, rings, etc., machine for punching, B. J. Lindgren	912,007
Dispensing apparatus, E. Davis	911,946
Display stand, E. M. Graham	911,871
Ditching machine, A. McDonald, et al	911,747
Door, fireproof, O. E. Moulton	911,836
Door, grain, T. J. Campbell	911,701
Door hanger, J. Simpson	912,192
Door operating device, T. J. Naulty	912,019
Door trolley track, sliding, G. Lane	911,824
Draft rigging, friction, J. F. O'Connor, 911,901,	911,902
Driving and reversing mechanism, F. Snow, 912,043 to	912,045
Driving and reversing mechanism, combined, C. G. Hawley	911,978
Drum snare strainer, J. E. Lyncham	911,809
Drum snare strainer and muffler, W. F. McIntosh	911,605
Dye and making same, orange lake, R. Lauch	912,138
Dye and making same, red cotton, R. Schule	912,182
Electric circuit, phantom, H. B. Stone	911,774
Electric controlling system, D. C. Jackson	911,878
Electric fixture outlet bracket, N. Hublinger	911,989
Electric induction motor, multiphase, H. A. Mavor	912,144
Electric machine, dynamo, B. Elshoff	911,708
Electric machine, dynamo, E. C. Wright	911,797
Electric motor, G. Seidel	912,037
Electromagnetic structure, method of and means for securing in position conductors of, B. Frankenfield	911,713
Electroplating apparatus, J. T. Daniels	911,578
Elevator, M. E. Neenan	912,256
Elevator controlling mechanism, T. Larsson	911,888
Elevator locking device, A. G. Rose, Jr	911,765
Elevator safety appliance, T. Rowley	912,173
Elevator safety device, M. D. Vanderheyden	911,631
Engine. See Explosion engine.	
Engine, C. I. Henrikson	911,590
Engine, W. H. McLeod	911,670
Engine crank box, gasoline, G. L. Lyon	911,891
Engine valve mechanism, gas, S. Jachimovics	911,992
Engravers' block, A. Muehlmatt	911,667
Engraving machine, V. J. Hansen	912,240
Envelop, G. M. J. Ahlstrom	911,800
Envelop, L. Levy	912,140
Explosion engine, T. Matson	912,012
Eyelet, F. H. Rees	911,762
Fan or pump, centrifugal, J. W. Kellogg	912,133
Fastener and seat, combined, C. W. Gill	911,972
Faucet, self-closing, P. W. Doherty	912,091
Fence clamp, woven wire, J. Fisher	911,963
Fence post, concrete, H. L. Ford	911,584
Ferment and producing it, A. D. Barr	911,803
Fertilizer distributer, J. K. Courdin	912,114
File, T. J. MacKay, Sr	911,736
Filter, E. Scheunert	911,682
Finger ring, C. M. Levy	912,139
Finger shield, A. W. Krieger	911,823
Fire alarm, V. Kail	911,730
Fire alarm circuits, circuit closer for, R. D. Tiffany	911,921
Fire escape, P. Nigro	912,152
Firearm telescope sight, G. F. Matteson	912,011
Fish hook, automatic, B. Timmons	911,781
Flour, core, W. Goldie	911,655
Flour machine, Snyder & Jacklin	911,913
Fluid pressure indexing mechanism, B. M. W. Hanson	912,124
Fluid sprayer, multiple, E. J. Frazier	912,106
Flying machine, W. D. Valentine	911,784
Forming machine, A. T. Sisson	911,911
Fowl roost, J. B. Mason	911,738
Frog, wrecking, G. E. Nyquist	912,155
Fruit carrier, C. A. Wellman	911,634
Fuel, composition for treating, E. H. Ellis	911,960
Furnace and converter twyer, blast, C. Robinson	911,614
Furnace or cupola bottom door hoist, J. Hyslop	911,726
Furnace twyer sight, blast, U. G. Davis	911,579
Furniture, J. Baumgartner	911,934
Fuse, impact, K. Wieser	911,792
Fuse, time, Schwartz & Koerner	911,845
Garment clasp, F. A. Traver	911,783
Garment display device, W. Mehler	912,145
Garment hanger, R. C. Thomas	912,047
Garment supporter, R. F. Bartel	912,060
Garment supporter, E. M. Tacy	912,204
Garter fastener, C. M. Simpson	911,772
Gas apparatus, A. L. Chak	911,572
Gas burner, G. S. Andrews	912,054
Gas generator, A. Ammentorp	911,801
Gas generator, water, McKay & Cheney	911,899
Gas heater automatic controller, Krein & Hargreaves	912,009
Gas main construction, Moore & Glazier	912,147
Gas, making, H. L. Doherty	911,869
Gas turbine engine, H. Lentz	911,825
Gaseous fuel, apparatus for igniting, Brown & Stinsing	912,066
Gases for general anaesthesia, apparatus for generating and administering, C. R. Cummins	912,231
Gate, I. A. Wesson	912,217
Gate automatic constant discharge, water, F. W. Hanna	911,720
Gate operating means, S. McChesney	911,668
Gates, etc., means for opening and closing, C. E. Barnes	912,058
Gear, carriage and wagon running, R. B. Sheridan	912,189
Gearing, friction, W. R. Jenkins	912,131
Glass bottle necks and stoppers therefor, grinding interchangeable ground, C. M. Conradson	911,809
Glass grinding machine abrading disk, I. Ramboux	911,759
Glass, process and apparatus for making plate, window, or wire, J. J. Quertinmont	911,678
Glass, molding frame for making sheet, plate, or wire, J. J. Quertinmont	911,679
Grain separator, G. Feickert	912,008



A Construction Record

WHEN your city traction system feels the press of growing crowds, you go back and forth with mind intent on home or office. Not so the manager; he watches the power.

So in Boston recently there was found urgent need of increasing the power which drives the elevated and surface lines of the city. It was quickly decided to enlarge three of the power stations and to install 20,000 horse power of new machinery.

The stations had to be built in the shortest time consistent with good construction. We were engaged to do the work and agreed to turn over the new equipment ready for operation within one year. Many doubted and watched.

In ten months precisely at the opening of the heaviest two traffic months of the year, we had completed the work without at any time interrupting the regular operation of the stations which we were enlarging.

We are able to take care of such emergencies as this because our service is backed by twenty years' experience in actually running large railway power plants and systems—experience of decisive value to the men who

Design and Construct Water Powers, Steam Electric Plants, Power Transmission Systems, Electric Railways and Buildings and Electrify Steam Railroads

"Came the Power with the Need" is the story in booklet form of the contract outlined above

Stone & Webster Engineering Corporation
Stone & Webster Building Boston, Massachusetts

FORE RIVER SHIPBUILDING COMPANY.
—CURTIS MARINE TURBINES.—
QUINCY, MASS.
—HIGH GRADE FORGINGS.—
SHIPBUILDERS & ENG'RS.
BUILDERS OF
—U.S. BATTLESHIP—
"VERMONT"
FLYING THE FLAG OF BATTLE EFFICIENCY
U.S. ATLANTIC FLEET.

Save Money by Machinery!

You can do this easily with the right machine in all furniture factories.

DODDS' TILTING CIRCULAR SAW

up-tilts to 45 degrees, simplifies the work and insures perfect accuracy in cutting. Removable throat in table, 12-inch rip or cross-cut saw with each machine. Write for free illustrated catalogue and price list.

ALEXANDER DODDS, Grand Rapids, Mich., U. S. A.

Dwiggins Lifetime Quality Fences

"Cost Less Than Wood"

LAWN, FARM AND POULTRY FENCES, GATES, ETC. Highest Grade. All Work Guaranteed

Large Illustrated Catalog and Special Prices FREE.
Dwiggins Wire Fence Co., 87 Dwiggins Ave., Anderson, Ind.

WRITE FOR BEST BUGGY OFFER

in America, on famous Columbus Buggies—at prices that save you big money. Lowest factory prices offered by anyone, shipped on one month's approval, 2 years' guarantee. Get new free catalog.

3 years guarantee

Columbus Carriage & Harness Co.
Station C83 Columbus, O.

EXPERT SHORTHAND

Taught by PRACTICAL COURT REPORTERS at your home and in our schools. Our graduates reported speeches of both of the leading candidates in the recent presidential campaign. One of our graduates holds the GOLD MEDAL in the last world's championship contest.

Catalogue sent free. Address the school nearer you.

SUCCESS SHORTHAND SCHOOL
204 Broadway, NEW YORK CITY
402 Clark St., CHICAGO, ILL.

Grow Mushrooms

For Big and Quick Profits.

Ten years experience enables me to give practical instructions that will add $5 to $60 per week to your income without interfering with regular occupation. For full particulars and free book, address JACKSON MUSHROOM FARM, 3331 N. Western Ave., Chicago, Ills.

New Spring and Bottling House

Poland Water

Leads All in

Purity, Medicinal Properties and Sales

Send for New Descriptive Water Book

Poland Spring Company

1180 Broadway, New York

HIRAM RICKER & SONS, Proprietors

Poland Spring, Maine

Speed, Safety, Service

All the utility of the bicycle without exertion; wonderful hill climbing power at a touch. All the speed you care to ride. Comfort and safety too. Distance at lower cost than with any other mechanical transportation. All this and more is enjoyed by the owner of an

R-S Motorcycle

Models for 1909 have exclusive features that give easiest riding, longest service and lowest cost of operation and maintenance. Our catalogue tells why and gives the proof. Sent free.

Liberal proposition to high grade agents where we have no representative. Write for details.

READING STANDARD CO., 408 Water St., Reading, Pa.

BAKER & BATAVIA GUNS

SAFE STANDARD TIME-TESTED GUARANTEED

A COPY OF THE BAKER GUNNER ON REQUEST

BAKER GUN & FORGING CO.
BATAVIA, N.Y. U.S.A.

ROTARY PUMPS AND ENGINES

Their Origin and Development.—An important series of papers giving a historical resume of the rotary pump and engine from 1588 and illustrated with clear drawings showing the construction of various forms of pumps and engines. 28 illustrations. Contained in SUPPLEMENTS 1109, 1110, 1111. Price 10 cents each. For sale by Munn & Co. and all newsdealers.

Don't Be A Wage Slave

MAKE $3,000 TO $5,000 A YEAR

BE A DOCTOR OF MECHANO-THERAPY

We Teach You By Mail At Home

Our Free Book tells how in a few months you may free yourself forever from wage slavery, from situation hunting and exacting employers. It tells how you may be a graduate in Mechano-Therapy, acknowledged to be one of the most elevating and highest paid professions for men and women—superior to Osteopathy, equal to a college course. Diplomas to Graduates. Endorsed by physicians and hundreds of graduates. Social and financial advancement assured. Special terms now. Write at once for Free Book.

AMERICAN COLLEGE OF MECHANO-THERAPY
Dept. 735. 120-122 Randolph St. Chicago

How to Build a 5 H.P. Gas Engine at Home

In Scientific American Supplements 1641 and 1642, E. F. Lake describes simply and thoroughly how a five horse power gas engine can be built at home. Complete working drawings are published, with exact dimensions of each part. Price by mail for the two Supplements, 20 cents.

Order from your newsdealer or from

MUNN & COMPANY
Publishers
361 Broadway, New York

Grappling device, Shields & Ace 911,684
Grinder, rotary, T. A. Panyard 912,250
Grinding disk sliding spindle, J. Miller, Jr. 911,896
Gun, barrel recoil, M. Hermsdorf 911,818
Gun, breech loading safety, O. Scott 911,683
Gun carriage, N. Koch 912,135
Gun receiving vehicle, portable, M. Dreger .. 911,810
Gun, recoil, K. Theele 911,849
Gun sight, D. B. Harris 911,721
Gun sight, G. M. Wanee 912,090
Hair curler, H. N. Northrop 912,154
Hair waving device, J. C. Bradley 911,571
Hame and tug connection, B. F. Emery 911,650
Hammer, H. Symonds 911,779
Hammer, pneumatic, A. J. Doughty 912,234
Hammock or swinging seat and supporting frame therefor, W. S. Bowis 911,570
Handle. See Adjustable handle.
Handle attachment, F. E. Whitney 911,791
Harness stay, G. L. Forman 911,965
Harrow riding attachment, J. R. Trotter ... 912,048
Harvester, A. J. Farton 911,754
Hat brim curling machine, J. P. Rochford. 911,615
Hat fastener, A. A. Roberts 911,764
Hat ventilator, W. R. Montgomery 911,740
Hay loader, R. L. Mealus 911,665
Head rest, J. C. Bahr 911,933
Headless and threadless bolt, J. J. Sauder. 911,624
Heat regulator, C. F. Rukes 912,175
Heater, J. T. Burr 912,069
Heating apparatus, steam, M. P. Osbourn... 911,751
Heel lift cutter, R. W. Perry 911,905
Hinge, L. W. Ashley 911,694
Hinge socket cutter, J. Salois 911,909
Hitching device, J. Siemsen 911,771
Hog hanger, E. Shively 911,770
Hoisting apparatus, F. P. Joseph 911,883
Hoof trimmer, J. R. Peifer 912,161
Hoop projecting device, C. M. Bartholomew. 912,069
Horse, etc., automatic fountain, G. C. Hart 912,241
Horse detacher, E. E. Sanders 912,032
Horse headlight attachment, P. A. Libby .. 911,733
Horsehair and other cellulose products having resistance and elasticity, manufacture of, E. Crumiere 911,808
Horseshoe, Dunn & McKaig 911,812
Horseshoe, H. Paar 912,258
Horseshoe, cushioned, F. Steelman 911,914
Hose clamp, P. E. Erickson 912,097
Hose coupling, T. B. Reid 911,840
Hub, M. S. Towson 911,922
Hydrocarbon furnace, J. Grow 911,587
Insulating high voltage transmission lines, W. T. Goldsborough 911,973
Interlocking machine, J. S. Hobson 911,723
Internal combustion engine, A. O. McCollum 912,150
Iron and steel, manufacturing, C. Ellis 911,870
Ironing machine, O. W. Powell 912,271
Jars, lifting tongs for fruit, P. O. Kaffke .. 911,906
Jet condenser, W. B. Potter 912,167
Kiln, J. E. Kennedy 912,658
Kinematograph apparatus, R. A. Fauconnet. 911,710
Kinetoscope, C. J. Lang 912,137
Knife sharpening machine, J. Muller 911,744
Knitting machine, W. D. & L. C. Huse, reissue 12,917
Knitting machine plating device, E. A. Hirner 911,656,
Ladder, painter's, A. B. Thompson 911,919
Lamp filaments, solder for incandescent, H. Kuzel 912,245
Lamp, hydrocarbon inverted mantle, O. J. Seehausen 912,185
Lamp, illuminating sign, J. G. Saftig 912,178
Lamp, metal filament electric glow, H. Kuzel 912,247
Lamp wick, safety, J. C. Smith 911,622
Lasts, forming, E. J. Prindle 912,027
Lawn sprinkler, H. Gibbs 911,716
Leg, artificial, D. B. James 912,150
Letter facing tray, M. S. Field 911,711
Leveling instrument, E. A. Bostrom 912,065
Lifting jack, W. E. Allgeo 911,638
Lifting jack, J. A. Mills 912,270
Line and trace holder, combined, I. L. Carlton 911,938
Linotype machine, H. Larsen 911,887
Linotype machine, W. H. Scharf 912,180
Liquid discharging device, W. C. Morrill ... 911,834
Liquid meter, E. L. Barnes 911,641
Liquids, heating, P. M. C. Mauvernay 911,829
Locking clamp, P. J. Bernard 911,936
Locking receptacle, automatic, J. W. Carter 912,071
Locomotive engine, McLain & Pierce 912,272
Loom, A. E. Stafford 912,083
Loom, automatic weft replenishing, J. C. Brooks 911,643
Loom filling exhaustion indicating mechanism, C. E. Nutting 912,257
Loom filling exhaustion indicating mechanism, A. E. Rhoades 912,264, 912,265
Loom weft feeler, J. Northrop 911,672
Lubricator, E. McCoy 911,669
Mail and parcel binder, A. M. Jayne 911,820
Mail box, rural, A. C. Baumwart 911,935
Mail catcher, Ramsey & West 911,760
Mail marking machine, F. C. Ielfield 912,244
Mail packeting machine, Reifenstein & Fox. 911,763
Manhole guard, disappearing, R. Parks 911,755
Manifolding device, O. M. Delesdernier ... 911,580
Manure spreader, C. W. Smith 911,620
Massage applying apparatus, internal, F. L. Talcott 912,205
Massaging device, W. I. Miller 912,016
Match box, E. E. McNeil 911,671
Measuring and computing apparatus, self, E. Nicholas 911,750
Measuring instrument, J. J. Jones 911,729
Measuring instrument, E. Schattner 912,181
Measuring the humidity in or determining the evaporating power of the air, apparatus for, M. M. Hastings 911,875
Meat labeling machine, R. A. Pearson 911,676
Meat rack, L. J. Berkowitz 911,567
Mechanical movement, W. H. Gaskill 912,108
Medical implement, Parks & Cross 912,024
Metal box, G. Klenk 911,598
Metal cleaning, polishing, and plating compound, M. Curtin 912,081
Metal planer, H. Bertram 912,063
Metal plate feeding, etc., feed mechanism for, G. H. Benzon, Jr. 911,566
Metal wheel, pressed, R. T. J. Martin 912,010
Meter. See Liquid meter.
Milk strainer cloth fastener, I. Focht 911,583
Milling and like machine, G. Reyher 911,841
Mirrors, etc., holder for frameless, W. R. Bickford 911,568
Mold, J. K. Williams 911,861
Mold filling and tamping apparatus, O. P. Raber, et al 911,757
Molding bases upon fence posts, machine for, C. S. Long 912,249
Mop head, J. S. Sourek 911,773
Mop head, L. V. Merriam 911,804
Mop wringer, J. Santin 912,033
Motor control, H. H. Clark 912,074
Motor control system, G. F. Atwood 911,932
Mower, lawn, W. E. Hake 911,719
Mower, lawn, T. Farr 911,902
Mower, lawn, J. C. Highfield 912,127
Mower or reaper cutting apparatus, S. Pierson 912,164
Music sheet controlling device, T. P. Brown 912,068
Musical instrument automatic player, J. J. Walker 911,789
Note book, C. H. Goodyear 912,112
Note book, loose leaf, C. H. Goodyear 912,111
Nut machine, F. Lackner 911,599
Oil burner, O. S. Davis 911,704
Orange clipper, W. Leven 912,248
Ores of iron, smelting, E. D. Kendall, reissue 12,918
Organ, pipe, H. Tellers 911,918
Oven, bake, P. Ahlheim 911,799
Oven or furnace door, coke, J. Whitaker ... 912,218
Overcoat, J. Burnett 912,208
Package tie, V. N. Stone 912,202
Packing, S. E. Condon 911,808
Packing, joint, W. J. Knox 911,822
Packing ring expander, W. H. Richardson .. 912,031
Panle bolt, R. G. Voight 912,211
Paper clip or clasp, C. B. Simmons 912,191
Paper file and binder, E. Cloyes 912,075
Paper making machine press roll, W. C. Nash 912,254, 912,255
Paper reel, C. E. Pope 912,262
Pavement, W. E. Hassam 912,126
Pencil sharpener, E. Sutherland 911,778
Phonograph horn attachment, G. Shephard. 912,039
Piano action, Lohr & Berglund 912,008
Pigments, producing, A. Moffatt 911,832
Pigments, producing composite, A. Moffatt.. 911,833
File driver, O. Crosby 911,574
Piling, W. Neilson 912,020, 912,021

Books Practical Scientific Books Valuable Technical Books

AGRICULTURE.—The New Agriculture. By T. Byard Collins. 12mo.; 374 pages; 106 illustrations $2.00

A popular outline of the many changes which are revolutionizing the methods of farming, and the habits of farm life. It is one of the most practical treatises on the subject which has ever been issued.

ALCOHOL.—Industrial Alcohol. Its Manufacture and Uses. By John K. Brachvogel. 8vo.; 528 pages; 107 illustrations. $4.00

A practical treatise based on Dr. Max Maercker's "Introduction to Distillation," as revised by Drs. Delbruck and Lange, comprising raw material, mashing and yeast preparation, fermentation, distillation, rectification and purification of alcohol, alcoholometry, the value and significance of a tax-free alcohol, methods of denaturing, its utilization for light, heat, and power production, a statistical review, and the United States law.

AMATEUR MECHANICS.—Home Mechanics for Amateurs. By George M. Hopkins. 12mo.; 370 pages; 326 illustrations. $1.50

This is a thoroughly practical book by the most noted amateur experimenter in America. It appeals to the boy as well as the more mature amateur. Holidays and evenings can be profitably occupied by making useful articles for the home or in the building of small engines or motors or scientific instruments.

AMUSEMENTS.—The Scientific American Boy. By A. Russell Bond. 12mo.; 317 pages; 340 illustrations $2.00

This is a story of outdoor boy life, suggesting a large number of diversions which, aside from affording entertainment, will stimulate in boys the creative spirit. In each instance complete practical instructions are given for building the various articles.

COMPRESSED AIR.—Compressed Air. Its Production, Uses, and Application. By Gardner D. Hiscox. 8vo.; 665 pages; 540 illustrations $5.00

The most complete book on this subject. It treats on its physical and operative properties, and is written by an expert. Taken as a whole it might be called an encyclopedia of compressed air.

DIES.—Their Construction and Use for the Modern Working of Sheet Metals. By Joseph V. Woodworth. 8vo.; 384 pages; 505 illustrations. $3.00

A most useful book, and one which should be in the hands of all engaged in the press working of metals; treating on the designing, constructing, and use of tools, fixtures and devices, together with the manner in which they should be used in the power press, for the cheap and rapid production of sheet metal articles.

ELECTRICITY.—The Standard Handbook for Electrical Engineers. Written and compiled by a Staff of Specialists. Second edition, corrected. 12mo; 1285 pages; 1260 illustrations. Bound in flexible morocco $4.00

A new pocketbook consisting of twenty sections; each written by a specialist of engineering experience and containing the latest data and information regarding standard electrical practice.

ELECTRICITY.—Electrician's Handy Book. By T. O'Conor Sloane. 761 pages; 556 illustrations. Hansomely bound in red leather, pocket-book style $3.50

This work is intended for the practising electrician who has to make things go. Although the principles of electricity and magnetism are treated, the greater part of the book is devoted to practical handling of machinery, details of construction, and computations such as will be encountered in every-day practice.

GAS ENGINES.—Modern Gas Engines and Producer Gas Plants. By R. E. Mathot. 8vo.; 314 pages; 152 illustrations. $2.50

A practical treatise setting forth the principles of gas engines and producer design, the selection and installation of an engine, conditions of perfect operation, producer gas engines and their possibilities, the care of gas engines and producer gas plants, with a chapter on volatile hydrocarbon, and oil engines.

GAS ENGINES.—Gas, Gasoline, and Oil Engines. Including Producer Gas Plants. By Gardner D. Hiscox. 8vo.; 442 pages; 351 illustrations $2.50

A complete book on the subject for gas engine owners, gas engineers, and intending purchasers of gas engines, treating fully on the construction, installation, operation, and maintenance of gas, gasoline, kerosene, and crude petroleum engines, with special information on producer and suction gases.

GAS ENGINES.—Gas Engine Construction. By H. V. A. Parsell and A. J. Weed. 8vo.; 304 pages; 145 illustrations. $2.50

A practical treatise describing the theory and principles of the action of gas engines of various types, and the design and construction of a half-horse-power gas engine, with illustrations of the work in actual progress, together with the dimensioned working drawings giving clearly the sizes of the various details.

HEATING.—Practical Steam and Hot Water Heating and Ventilation. By Alfred G. King. 8vo.; 402 pages; 304 illustrations. $3.00

An original and exhaustive treatise, prepared for the use of all engaged in the business of steam, hot water heating, and ventilation. The standard and latest book published. Describes all of the principal systems of steam, hot water, vacuum, vapor, and vacuum-vapor heating, together with the new accelerated systems of hot water circulation, including chapters on up-to-date methods of ventilation.

HYDRAULICS.—Hydraulic Engineering. By Gardner D. Hiscox. 8vo.; 315 pages; 305 illustrations $4.00

A practical work treating on the properties, power, and resources of water for all purposes, including the measurement of streams, the flow of water in pipes or conduits; the horse-power of falling water; turbine and impact water wheels; wave motors; centrifugal, reciprocating, and air-lift pumps, etc.

INDUCTION COILS.—The Design and Construction of Induction Coils. By A. Frederick Collins. 8vo.; 290 pages; 140 illustrations. $3.00

This work gives in minute details full practical directions for making eight different sizes of coils, varying from a small one giving a ⅛-inch spark to a large one giving 12-inch sparks. The dimensions of each and every part down to the smallest screw are given, and the descriptions are written in language easily comprehended.

LATHE.—Modern American Lathe Practice. By Oscar E. Perrigo. 8vo.; 424 pages; 314 illustrations $2.50

A new book describing and illustrating the very latest practice in lathe and boring mill operations, as well as the construction of and latest developments in the manufacture of these important classes of machine tools.

MAGIC.—Magic, Stage Illusions, and Scientific Diversions. Including Trick Photography. Compiled and edited by Albert A. Hopkins. 8vo.; 568 pages; 420 illustrations $2.50

This very interesting volume is acknowledged to be the standard work on magic. It appeals to the professional and amateur alike. The illusions are all explained in detail, showing exactly how the tricks are performed.

MECHANICAL MOVEMENTS.—Mechanical Movements, Powers, and Devices. By Gardner D. Hiscox. 8vo.; 403 pages; 1,800 illustrations $3.00

This is a collection of different mechanical motions and appliances, accompanied by appropriate text, making it a book of great value to the inventor, the draftsman, and to all readers with mechanical tastes.

MECHANICAL APPLIANCES.—Mechanical Appliances, Mechanical Movements, and Novelties of Construction. By Gardner D. Hiscox. 8vo.; 396 pages; 970 illustrations. $3.00

This book, while complete in itself, is in fact a continuation of the author's "Mechanical Movements, Powers, and Devices." The author presents to the reader information regarding nearly all conceivable devices for producing motion or accomplishing mechanical results.

SPECIAL OFFER: These two volumes sell for $3 each, but when they are ordered at one time from us, we send them prepaid to any address in the world, on receipt of $5.

PATENTS.—Practical Pointers for Patentees. By F. A. Cresee. 12mo.; 144 pages. $1.00

Containing valuable information and advice on the sale of patents and elucidation of the best methods employed by the most successful inventors in handling their inventions. It gives exactly that information and advice about handling patents that should be possessed by every inventor who would achieve success.

PHYSICS.—Experimental Science. Elementary, Practical, and Experimental Physics. By George M. Hopkins. In two volumes. 8vo.; 1,105 pages; 918 illustrations. Cloth, $5.00. Half morocco, ... $7.00

This book treats on the various topics of physics in a popular way and describes with rare clearness and in detail the apparatus used, and explains the experiments in full, so that teachers, students, and others interested in physics may readily make the apparatus without great expense and perform the experiments without difficulty.

PLUMBING.—Modern Plumbing Illustrated. By R. M. Starbuck. 392 pages; 10¼ x 7⅛; 55 full-page engravings. $4.00

A comprehensive and up-to-date work illustrating and describing the drainage and ventilation of dwellings, apartments, and public buildings, etc. The very latest and most approved method in all branches of sanitary installation are given.

PUNCHES.—Punches, Dies, and Tools for Manufacturing in Presses. By Joseph V. Woodworth. 8vo.; 483 pages; 702 illustrations. $4.00

This work is a companion volume to the author's other work entitled "Dies, Their Construction and Use." It might well be termed an encyclopedia on die making, punch making, die sinking, and sheet metal working.

RECEIPTS.—The Scientific American Cyclopedia of Receipts, Notes and Queries. Edited by Albert A. Hopkins. Containing 15,000 selected formulas. 8vo.; 734 pages. Cloth, $5.00. Sheep, $6.00. Half morocco, ... $6.50

Over 15,000 selected receipts are here collected, nearly every branch of the useful arts being represented. The alphabetical arrangement with abundant cross references makes it an easy work to consult. It has been used with equal success by chemists, technologists, and those unfamiliar with the arts, and is a book which is useful in the laboratory, factory, or home.

REFERENCE BOOK.—Scientific American Reference Book. Compiled by Albert A. Hopkins and A. Russell Bond. Containing 50,000 facts. 12mo.; 516 pages; illustrated. $1.50

This book deals with matters of interest to everybody. It contains 50,000 facts, and is much more complete and more exhaustive than anything of the kind which has ever been attempted. It is indispensable to every family and business man. It is a book for every-day reference—more useful than an encyclopedia, because you will find what you want in an instant in a more condensed form.

STEAM ENGINE.—Modern Steam Engineering in Theory and Practice. By Gardner D. Hiscox. 8vo.; 487 pages; 405 illustrations $3.00

This is a complete and practical work issued for stationary engineers and firemen, dealing with the care and management of boilers, engines, pumps, superheated steam, refrigerating machinery, dynamos, motors, elevators, air compressors, and all other branches with which the modern engineer must be familiar.

TELEPHONE.—Telephone Construction, Installation, Wiring, Operation, and Maintenance. By W. H. Radcliffe and H. C. Cushing, Jr. 16mo.; 171 pages; 125 illustrations $1.00

A practical book intended for electricians, wiremen, engineers, contractors, architects, and others interested in the installation of telephone exchanges in accordance with standard practice. Intricate mathematics are avoided and all apparatus, circuits, and systems are thoroughly described. Selected wiring tables, which are very helpful, are also included.

TOOLS.—American Tool Making and Interchangeable Manufacturing. By Joseph V. Woodworth. 8vo.; 535 pages; 601 illustrations. $4.00

A complete practical treatise containing a valuable collection of drawings and descriptions of devices, the results of the author's own experience.

TOOLS.—Modern Machine Shop Tools. By W. H. Vandervoort. 8vo.; 552 pages; 673 illustrations $4.00

A new and fully illustrated work describing in every detail the construction, operation, and manipulation of both hand and machine tools; being a work of practical instruction in all classes of machine shop practice.

WIRING.—Electric Wiring, Diagrams and Switchboards. By Newton Harrison. 12mo.; 272 pages; 105 illustrations. $1.50

This work is a thoroughly practical treatise on electric wiring in all its branches, beginning with the simple circuit and working up to the practical every-day problems, all being presented in a simple and intelligent manner. It is in every respect a handy, well written, instructive, comprehensive volume on wiring for the wireman, foreman, contractor, or electrician.

Our new 48-page catalogue containing description of the above books sent free on application

MUNN & COMPANY, - Publishers, - 361 Broadway, New York City

Our Improved Method of

FINISHING FLOORS

old or new, for rugs or otherwise, with

GRIPPIN'S

FLOOR CRACK FILLER AND FINISHES

Sanitary, inexpensive and simple to apply.
A SAMPLE showing how (while they last), and descriptive matter FREE.
Write now

GRIPPIN MFG. CO.
Dept. 6 NEWARK, N. Y.

STYLE ECONOMY — WATERPROOFED LINEN LITHOLIN COLLARS & CUFFS — FIT COMFORT

The All-Round Collar

LITHOLIN WATERPROOFED LINEN COLLARS

are ready for wear, fresh and neat, at any moment. Suitable for all men and all occasions—hard work, rough sport or dainty dress. They are linen and look it, but can be wiped white as new with a damp cloth. Save time, annoyance, and money. Won't wilt, crack or fray. You can get them in any style and size.

COLLARS 25c. CUFFS 50c.

Always sold from a RED box. Avoid Substitution.

If not at your dealer's, send, giving style, size, how many, with remittance, and we will mail, postpaid.

THE FIBERLOID COMPANY
Dept. 22, 7 Waverly Place, New York

Make a Motor Boat of any Boat in 5 Minutes

You can do it with the Waterman Outboard Motor which you can quickly attach (and detach) to the stern of any skiff, row boat, dinghy, punt, sail boat, and have a good motor boat. It is not a toy, but a reliable 2 H. P. Marine Motor that will drive an 18 foot row boat 7 miles an hour, 4 hours on gallon gasoline. Simplest motor made. Weight 40 lbs. Equipped with *Schebler carburetor.* Four years' successful results behind it. Send for Catalog C. Canoe Motors 1, 2, 3, 4 Cylinders—Catalog K. Standard Type Motors, 1 to 30 H. P.—Catalog A.

WATERMAN MARINE MOTOR CO.
1509 Fort St. West, Detroit, Mich.

A. B. C. AUTOMOBILE

A fine hill climber. Speeds up to 35 miles an hour. Most simple, practical, powerful and durable Automobile of its class. Easy to operate—no complicated parts—no repairs. Solid or pneumatic tires. Air or water cooled. Safest and best. Built for 2, 3 or 4 passengers, 16 to 35 h. p. $600 up. Catalog Free. Write today for particulars.

Catalog Free

A.B.C. MOTOR VEHICLE MFG. CO., 3914 Morgan St., St. Louis, Mo.

SENSITIVE LABORATORY BALANCE

By N. Monroe Hopkins. This "built-up" laboratory balance will weigh up to one pound and will turn with a quarter of a postage stamp. The balance can be made by any amateur skilled in the use of tools, and it will work as well as a $125 balance. The article is accompanied by detailed working drawings showing various stages of the work. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1184.** Price 10 cents For sale by MUNN & Co., 361 Broadway, New York City, or any bookseller or newsdealer

Duryea's Buggyaut

2 cyl., 2-cycle, air-cooled
Simplest ever seen. $650

CHAS. S. DURYEA, Reading, Pa.

Great Droughts and Crop Famines!
Dry Rivers and Raging Floods!
Fat Farm Lands Swept into the Sea!
The Cost of Decent Living Doubled!

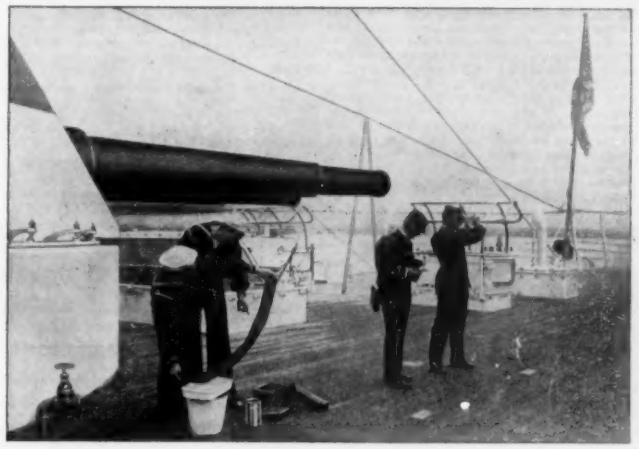
All certain within fifty years unless the reckless looting of the forests is stopped. The greatest menace to the people ever uncovered—in

MARCH TECHNICAL WORLD MAGAZINE

February 17 - - 15c.

On All News Stands

Pins, etc., safety attachment for stick, P. Rittersbacher	912,170
Pipe attachment, tobacco, W. E. Frazee	912,105
Pipe hanger, W. L. Iwan	911,877
Pipe or hose coupling, L. S. Dismuth	912,233
Pipe vise, A. Senn	912,187
Pitmen safety device, Thiessen & Becker	912,046
Pivot crane, adjustable counterbalance, W. Van Wie	911,632
Plant protector, S. D. Scott	912,184
Planter dropping mechanism, J. A. Anderson	911,691
Plate, wear, J. E. Hovendick	911,986
Plow and sweep holder, A. C. French	911,586
Plow, gang, H. C. Clay	911,765
Plug receptacle, armored, R. A. Schoenberg	911,844
Pneumatic action construction, C. H. Thompson	912,207
Pocket knife, G. W. Soderstrand	912,197
Poke, hog, T. L. Douglass	911,706
Pole climber, H. C. Hansen	912,123
Polishing machine, C. G. Ferguson	912,102
Potato cutter, seed, F. A. Newman	911,900
Pottery ornamentation, A. L. Rock	912,171
Power apparatus, Sperry & Eby	911,625
Power drill, hand, L. S. Pfouts	911,755
Press feeder's finger stall, A. V. Napier	911,838
Printing block molding machine, P. Bunau-Varilla	912,228
Printing plate, M. A. Droitcour	912,093
Printing plates, casting of curved stereotype, D. W. Jones	911,882
Printing plates, making, M. A. Droitcour	912,092
Printing press, H. F. Anderson	911,930
Projectile, G. H. Hoxie	911,591
Propeller, weedless or self-clearing, W. L. Cassaday	911,939
Pump, A. Blauvelt	911,569
Pump, F. Woodhead	911,929
Pump, H. L. Perrine	912,625
Pump, deep well, R. C. Purcell	911,609
Pump, mechanical mercury sealed vacuum, M. von Recklinghausen	911,610
Pump strainer, W. S. Dunstedter	911,959
Putty knife, W. A. Prout	912,028
Rack and holder, combined, O. M. Harding	911,976
Radiator, A. Landon	912,002
Radiator, O. T. Brown	912,067
Rail clamp, J. M. Vail	911,686
Rail connection, A. McCafferty	911,837
Rail fastener, W. Wallace	911,790
Rail fastener, L. R. Gifford	911,970
Railway alarm signal, J. Shavalier	911,769
Railway and tramway reinforced concrete sleeper, Liebeaux & Hennebique	911,734
Railway automatic safety appliance, R. D. Farrell	911,961
Railway brake beam, S. A. Crose	911,867
Railway coach indicator, street, E. Miller	911,666
Railway crossing, O. F. Jordan	911,994
Railway crossing, G. P. Keith	911,997
Railway crossing signal, H. W. Souder	911,623
Railway noise deadening means, C. E. Lewis, et al	912,141
Railway safety appliance, T. McGuire	912,017
Railway sleeper, reinforced concrete, M. Brukner	912,227
Railway switch safety appliance, Bishop & Kidd	912,064
Railway system, electric, W. E. & J. W. Dawkins	911,948
Railway tie, R. C. Lukens	911,691
Railway tie, A. Heath	911,979
Railway tie, metal, S. McElfatrick	912,151
Railway tie plate, Smith & Hershberger	912,195
Range burner adjustment, gas, B. J. Taylor	911,916
Razor blade stropping implement, W. H. Nicholls	911,839
Railway tie, F. A. Buse	911,700
Receptacle opening device, G. C. Weber	911,927
Record, abstract, W. K. Scarborough	912,179
Record packet, G. T. Williams	911,794
Reed motion, F. Ott	911,675
Refrigerating apparatus, R. Whitaker	911,635
Refrigerator, A. C. Sample	911,843
Relay, E. McClintock	911,746
Relay, F. B. Corey	912,079
Resistance, T. von Zweigbergk	912,267
Reversing mechanism, F. Snow	912,196
Rod adjusting device, L. Willis	912,221
Roost, T. Thompson	911,920
Rotary engine, W. D. Tutt	911,852
Rotary engine, H. P. McCann	912,253
Rubber, J. S. Ramlose	912,030
Sad-iron, H. Wonderlich	911,795, 912,222
Saddle device, harness, A. F. Montin	912,148
Sash holding means, window, W. S. Wright	911,690
Sash, window, C. S. Smallwood	911,619
Sawing machine sand feed, stone, J. M. Owens, et al	912,023
Scythe, A. S. & L. D. Orr	912,157
Semaphore, illuminated, A. D. Archibald	911,640
Semaphore signal, S. H. Harrington	911,588
Sewing machine attachment, E. J. Miller	912,015
Shade and curtain hanger, F. Davidson	912,084
Shaving cup, J. Handel	911,873
Shears, L. F. Regan	911,680
Sheet metal caddy for spices and other articles, Weber & Miller	911,859
Shoe cleat, L. J. F. Rooney	912,172
Shoe guard, J. Oliver	911,673
Shoe lace tip, J. Crooks	911,573
Shoe uppers, fastener for, M. Bergeron	912,226
Shrapnel, R. Wille	911,793
Sighting machine, B. A. Fiske, reissue	12,916
Sign, J. Igelstroem	911,991
Sign, interchangeable, A. C. Brose	911,699
Signal, W. H. Parrish, Jr	911,759
Sink, etc., support, J. Rendall	911,611
Sink and washtub, combination, W. M. De Lory	912,086
Slotting machine, C. G. Curtis	911,944
Smoke and spark destroyer, G. Z. Gray	911,817
Smoke consuming furnace, R. L. Walker	911,688
Smoke consuming furnace, L. Yoksch	912,022
Smoker's pipe, H. B. Saylor	912,034
Sound recorder, C. R. Borland	911,937
Spark arrester attachment, P. M. Low	911,827
Speed mechanism, variable, A. L. De Leeuw	911,951
Speed recorder, G. A. Lee	912,003
Spinning and winding machine, A. J. & H. A. Foulds	911,815
Spool holder, B. F. Ford	911,964
Sprag, A. Bendle	912,062
Sprayer, C. S. Perry	912,261
Spring hinge, G. H. Day	911,949
Spring wheel, G. A. Gustafson	911,975
Sprinkler head, H. Gibbs	911,717
Sprinkler system, automatic, G. M. Demarest	911,705
Sputum cup, H. J. Potter	912,263
Square, foldable carpenter's, C. L. Ruehs	912,174
Square, separable, W. J. Shuart	911,846
Stair carpet clamp, invisible, C. H. Seelye	911,767
Stairs or other supports, newel posts for, C. E. Paulson	912,260
Stalk cutter, F. P. Chapa	912,072
Steam and oil separator, H. J. Gebhardt	911,969
Steam cooking appliance, G. W. Ferguson	911,654
Steam engine, T. F. Scollard	912,183
Steam superheater, H. W. Jacobs	911,993
Stirrup, J. W. Haddock	911,718
Stock feeding device, automatic, F. Olsen	911,674
Stool, kitchen and laundry, B. A. Massey	911,893
Stop mechanism, automatic, F. Snow	912,042
Stop motion, rotary, F. Snow	912,040
Storage battery, electric, H. K. Hess	912,242
Stove, heating, E. B. Colby	912,077
Strap. See Trunk strap.	
Street sweeping machine, J. Banser	911,696
Street sweeping machine, V. D. Carroll	911,702
Stuffing box, S. E. Condon	911,807
Sugar bowl, S. Juel	911,995
Sulfur dioxid, making, C. W. Lyman	911,735
Surface finish, P. Neymann	911,696
Surgical instrument, B. S. Stephenson	911,627
Suspenders, A. F. Mofsch	911,743
Suspenders, A. Oppenheim	911,903
Suspenders cast off, W. B. Murphy	912,251
Switch, A. L. Vissat	912,049
Switch operating device, A. L. Huber	911,988
Switch starter, multiple, J. T. Janette	911,592
Syringe, F. S. Housinger	911,724
Syringe, hot air, H. E. Voger	911,687
Tag for neckwear, etc., E. S. Bachrach	912,225
Telegraphic key or transmitter, H. O. Putt	912,029
Telegraphy, radio, H. R. von Traubenberg	912,209
Telephone, O. Frazier	911,714
Telephone, desk, Corwin & Bais	911,866
Telephone exchange system, W. A. Wynne	911,798
Telephone exchanges, system for metering service on the lines of, C. M. Beattie	912,268
Telescope mounting, rifle, F. L. Smith	911,621
Telescope with double hinge, binocular, B. Straubel	911,776



KODAK

TELLS THE STORY

Of every world event—whether it is a peaceful cruise of a great navy around the globe, a war that changes the map of continents, a devastating earthquake, or the inauguration of a president, you now have the photographic story quickly and accurately told in the illustrated press.

The simplicity of the Kodak, the lightness and reliability of Kodak film and the convenience of the Kodak Film Tank have made this possible.

The Kodak System, means the absolute elimination of the dark-room, from every step of the work—loading, unloading, developing are "all-by-daylight." It means perfect simplicity and what is even more important—best results.

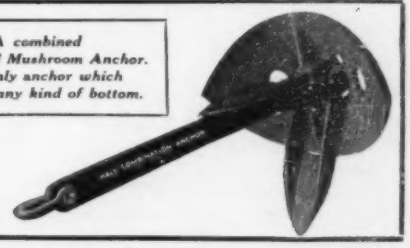
KODAKS, $5.00 to $100.00.

EASTMAN KODAK COMPANY,
ROCHESTER, N. Y., *The Kodak City.*

Ask your dealer or write us to put your name on list for spring catalogue of Kodaks—when ready.

THE HALL COMBINATION ANCHOR

A combined Fluke and Mushroom Anchor. The only anchor which holds in any kind of bottom.



Anchor Mfg. Co.
114 West 18th St., New York

The March 20th Issue of THE SCIENTIFIC AMERICAN

Will contain a SPECIAL ARTICLE on the

"High-Wheel Buggy-Type Automobile"

This article will be of a very comprehensive nature, and will give full details of the mechanism of all the latest machines of this kind—a type which is becoming very popular with farmers and country physicians, on account of its simplicity and freedom from tire trouble and repairs.

Watch for the March 20th Issue!

It will be well worth careful reading.

A TROUBLE CHART FOR AUTOMOBILE USERS.

We will mail free, to any automobilist or chauffeur, who cuts out and mails us this coupon, a copy of our 1909 Automobile Number containing a very complete chart that gives full particulars about how to locate the trouble when your car breaks down.

Engineering News

(ILLUSTRATED)

The Leading Engineering Paper of the World. For Civil, Mechanical, Mining and Electrical Engineers
100 to 125 pages, 9" x 13", weekly. Send ten cents for sample copy.
If you cannot locate desired engineering equipment write our "Readers Want" department.
THE ENGINEERING NEWS PUBLISHING CO. - - - 214 Broadway, New York

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than ten lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO.

PATENTS FOR SALE.

FOR SALE.—U. S. patent No. 905,608 on a new and useful improvement in window ventilators for houses, hospitals, trains, steamships, etc. Also the article itself at retail. Hymen Schlamowitz, 44 Allen St., N. Y. City.

Inquiry No. 8868.—Wanted to buy nickeloid for buttons.

FOR SALE.—Patent No. 909,585 Jan. 12, 1909. Train-order holding and delivering device for delivering orders to moving trains. Address L. J. Greene, Camden, Ga.

Inquiry No. 8869.—Wanted to buy straw making machinery.

FOR SALE.—An interest, or outright, a sanitary invention in the plumbing line. Now on the market. Address H., Box 773, New York.

Inquiry No. 8871.—For manufacturers or importers of metal known as "Kaiserium."

FOR SALE.—U. S. Patent No. 909,519. Canada Patent No. 115,285. Guard Rail Chair. No bolts, no creeping of guard rail. Guard rail not in way or disturbed when changing worn or broken main rails. Cash, or part cash and royalty deal. For full particulars address Eben P. Batchelder, Siskiyou, Ore.

Inquiry No. 8877.—For manufacturers of convex glass for pictures.

HELP WANTED.

LOCAL REPRESENTATIVE WANTED.—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition, and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. Address The National Co-operative Real Estate Company, Dept. 378, Washington, D. C.

Inquiry No. 8878.—For factory making paper out of peat.

SALESMEN WANTED.

SALESMEN WANTED.—For the spring rush. Hundreds of good openings all over the country for trained salesmen. Our Free Employment Bureau with offices in five cities is constantly in touch with thousands of the best firms in the country. Let us prepare you by mail in eight weeks for one of these high grade positions. We have placed hundreds of our graduates who had no former experience as salesmen in good positions where they now earn from $100 to as high as $500 a month and expenses. If you want to enter this great field, write our nearest office to-day for our free book "A Knight of the Grip." For further information and full particulars address Dept. 204, National Salesman's Training Association, Chicago, New York, Kansas City, Minneapolis, San Francisco.

Inquiry No. 8885.—For manufacturers of the "Mysterious Ball" like that of Mr. Lepere's—a man in a ball.

PARTNERS WANTED.

PARTNER WANTED.—Who can furnish money to construct an airship as per my patent No. 909,261. For particulars address William Rumble, 1802 Crotona Avenue, New York.

Inquiry No. 8880.—Wanted to buy a machine which breaks and divides apricot stones.

MISCELLANEOUS.

UNITARIAN LITERATURE, including sermons and weekly publications, sent free, on application to Miss Peck, 106 George Street, Providence, R. I.

Inquiry No. 8890.—For manufacturers of a milking machine.

Inquiry No. 8894.—For manufacturers of an automatic camera for making photographs on pin trays, etc.

Inquiry No. 8897.—For the manufacturers of the "Lid op" can opener.

Inquiry No. 8903.—For firms dealing in motor cars to suit Indian climate.

Inquiry No. 8904.—Wanted to buy new or second hand machinery for making "bow type," mouse and rat trap springs and wire parts, single machine or full outfit.

Inquiry No. 8907.—For address of New England Coil Winding Co.

Inquiry No. 8908.—For a dealer in tapes and cords for Venetian blinds.

Inquiry No. 8909.—For a machine to paint shade or blind rollers.

Inquiry No. 8911.—Wanted to buy steamfitter's tools and screw-cutting lathes.

Inquiry No. 8918.—For manufacturers of "Wydt's Electro-Catalytic Sparking Plug.

Inquiry No. 8920.—For a still for extracting alcohol from saw dust.

Inquiry No. 8921.—For the manufacturers of gilt paper.

Inquiry No. 8922.—Wanted the address of Worthington Boiler Co.

Inquiry No. 8925.—For an explosive turbine or rotary gasoline engine 6 or 8 H. P., must have a vertical shaft.

Inquiry No. 8926.—Wanted to buy a tree digger of steel plates which are forced down beside the tree and locked in position.

Inquiry No. 8927.—Wanted to buy an apparatus for sterilizing water at the tap by an ozonizer.

Inquiry No. 8928.—For the manufacturers of a steam rotary excavator as described in the Scientific American of December 12, 1908, page 547.

Inquiry No. 8929.—For makers of automatic gates that can be opened without the driver of a vehicle getting out.

Inquiry No. 8930.—For the address of the manufacturers of revolving gasoline motors.

Inquiry No. 8931.—For parties who manufacture the Western Stump Borer for boring stumps.

Inquiry No. 8933.—Wanted to buy machinery for the manufacture of hair mattresses.

Inquiry No. 8934.—Wanted to buy seal and book of blank stock certificate.

Inquiry No. 8936.—Wanted machinery used to spun or wrap paper pencils in the manner that paper pencils are made.

Inquiry No. 8938.—For firms making rotary gasoline engines.

Inquiry No. 8939.—For parties who build ammonia cold storage for eggs.

Inquiry No. 8940.—Wanted to buy machine or bender for rounding angle iron, flat iron and round end oblong tanks.

Inquiry No. 8941.—For manufacturers of machinery for making fly screens.

Inquiry No. 8942.—Wanted to buy apparatus to enable anyone with rheumatism or other causes to hold a penholder.

Inquiry No. 8943.—Wanted a portable band machine for breaking stones for installing road surface. To be worked by two or three men.

Inquiry No. 8944.—For the address of the manufacturers of the king or lever collar button.

Inquiry No. 8945.—Wanted address of manufacturers of casana starch machinery.

Inquiry No. 8946.—For the address of manufacturer or dealer of Floss cotton candy machine,

Inquiry No. 8947.—For the manufacturers of a machine to compel deep breathing called "Pneumaxeter."

Inquiry No. 8948.—For manufacturers of gearing, noiseless or otherwise, suitable for speed of 3,000 to 4,000 r. p. m. for wheels 5 inches diameter.

Inquiry No. 8949.—For manufacturers of a suction or vacuum street sweeper.

Thill coupling, T. A. Moran	911,897
Thill support, S. H. Story	911,775
Thread finishing and lustering machine, silk, E. Pohl	911,907
Threads by twisting, joining, W. R. Landfear	911,886
Threads, lustering and finishing silk, E. Pohl	911,906
Ticket holder, C. C. Gill	912,110
Ticket punch, C. B. Livermore	912,142
Tile ditching machine, E. A. Anderson	911,564
Time recorder, autograph, Cottrill & Leihammer	912,230
Tinning or coating machine, C. C. Roberts	911,613
Tire protector, G. C. Hoskin	911,984
Tobacco pipe, C. H. Schroeder	911,766
Toe calks, apparatus for making, J. C. Snider	911,912
Toilet article, C. F. Kohler	912,001
Tool, centering or marking, O. L. Albertson	912,052
Tool, counterboring, E. E. Veley	911,787
Tool holder, G. F. Krieger	911,999
Tool, motor, C. C. Allen	911,562
Toy, Mahan & Moran	911,602
Transmission mechanism, friction, J. P. Davis	911,947
Tray holder, S. M. Schaefle	912,035
Trolley replacer, electrical, H. L. Sparks	911,847
Trolley, self-restoring, J. T. Andrew	912,055
Trolley signal circuit controller, A. Bevan	911,608
Trolley wheel, I. O. Stant	912,199
Truck and gage wheel, implement, T. Wade, et al	911,788
Truck, fireman's, C. Holst	911,981
Truck pedestal, E. A. Curtis	911,575
Trunk strap, C. E. Miles	911,604
Try square, self-marking, W. Muck	911,898
Turbine, C. Roth	911,616
Turbine, Ljungstrom & Forsberg	911,602
Turbine, elastic fluid, C. W. Dake	911,576, 911,577
Turbine, elastic fluid, A. R. Dodge	912,090
Turbine, steam, A. H. Beckman	912,051
Turbine vane series, R. Ljungstrom	911,603
Twine holder, J. R. Armington	912,224
Twisting-in machine, W. R. Landfear	911,885
Type and type bar making machine, F. H. Richards	911,612, 912,169
Type setting machine attachment, H. A. Armstrong	912,056
Typewriter, N. F. Billing	911,805
Typewriter, etc., inking device, F. Dowd	911,707
Typewriting machine, L. S. Burridge	911,644
Typewriting machine, C. J. Rollefson	911,842
Typewriting machine, M. W. Pool	911,908
Typewriting machine, G. A. Greenwood	912,118
Typewriting machine, G. A. Selb	912,186
Typewriting machine, G. H. Smith	912,193
Typewriting machine, F. H. Richards	911,681
Umbrella, S. Perpich	912,163
Umbrella, M. N. Thayer	912,206
Umbrella, folding, R. G. Whitlock	911,636
Umbrella, folding, Jesdale & Wellde	911,728
Universal joint, J. Elkan	912,096
Valve, C. J. Christenson	912,073
Valve, blow-off, W. M. Tolles	911,782
Valve, dash pot, F. G. Tees	911,917
Valve for flushing tanks, float, W. N. Long	912,099
Valve for radiators, A. Sercely	912,188
Valve stem, F. J. Dahlberg	912,082
Valves in water supply systems, device for dislodging matter from, J. Conway	911,941
Vehicle bumper, H. H. Gardner	911,715
Vehicle lamp, motor road, C. Davis	912,232
Vehicle movement controlling means, F. E. Kinsman	911,595
Vehicle steering device, E. E. Evans	911,709
Vehicle, tilting ammunition, W. Mayer	911,830
Vehicle wheel, N. G. Long	911,826
Vehicle wheel, Gruenewald & Wright	912,119
Vending machine discharge mechanism, peanut, B. M. Davis	911,945
Ventilator. See Car ventilator.	
Ventilator, J. P. Ekstrom	911,648
Vessel, cargo, J. R. F. Dettmer	911,581
Violin mute, S. Ulbrich	911,853
Wagon bolster and standard, C. M. Shotwell	912,100
Wagon loading device, Voorhees & Speer	911,630
Washer cylinder door, F. Snow	912,041
Washing machine, G. L. Martin	911,737
Washing machine, J. W. Seifert	912,038
Washing machine, O. & M. Froese	912,107
Watch guard, J. Reep	911,761
Watch protector, M. Kaufman	911,657
Water closet, J. J. McGuire	911,748
Water closet flushing apparatus, W. U. Griffiths	911,872
Water closet seat, J. P. Cowan	911,942
Water glass and gage cock fountain, J. L. Vaughan	911,786
Water motor, A. G. Baum	911,697
Weighing machine, C. H. Dempsey	912,088
Wheel, T. H. Walbridge	912,026
Wheel guard, C. Johnston	911,881
Windmill, E. T. Parker	911,752
Window, A. J. Ellis	911,813
Window frame, C. S. Moore	911,742
Window screen, A. T. Moore	911,741
Window screen, roller, C. P. Flora	912,104
Window ventilating device, H. Krug	911,660
Winker brace, G. L. Forman	911,966
Wire and cable machine automatic measuring and stop mechanism, I. A. Ryan	912,176
Wire forming machine, F. Deering	911,950
Wire working machine, S. I. Armbruster	911,931
Wood or metal, implement or device for rubbing fillers into the pores of, Kelly & Peneley	911,731
Wood, protecting, D. C. Meehan	912,013
Wrench, J. Ertel	911,814
Wrench, L. Vader	911,924
Wrench, C. B. Green	912,117
Wrench, J. Ryan	912,177
Wrist developer and strength tester, V. M. del Valle y Zeno	911,925
Wristlet, R. N. Thomas	911,780
Yoke center, neck, A. W. Noonan	912,153

DESIGNS.

Book cover, C. A. Musselman	39,814
Corn holder, C. Homeisler	39,815
Emblem, H. P. Pratt	39,813
Fabric, textile, R. Gattiker	39,818 to 39,821
Stand, display, H. L. Beach	39,816
Type ornament, E. R. Estep	39,817

TRADE MARKS.

Ale, stout, porter, lager beer, and malt extracts, W. Albrecht	72,646, 72,647
Belting and hose, Peerless Rubber Manufacturing Co.	72,608
Belts, H. W. Levy	72,617
Bleaching powder, F. Cash	72,601
Canned fruits and vegetables, J. F. Pyle & Son	72,656
Canned fruits and vegetables, Guymon Petro Mer. Co.	72,683

TEN SHOTS IN ONE LOAD!

A Rapid Fire Gun in a Handful

The **Ten Shot Savage Automatic** smothers every adversary with the rapidity of its fire. Each trigger pull sends a bullet, ejects a shell, reloads. The pressure of a finger ejects the old magazine. There is never a last cartridge. Think what advantage this means over other types of fire-arms. Shot after shot can be poured into a mark at the rate of 180 to 240 shots a minute.

Each bullet, as it takes the rifling of the barrel, positively and automatically locks the breech—an exclusive feature of the

SAVAGE 32 Caliber AUTOMATIC PISTOL

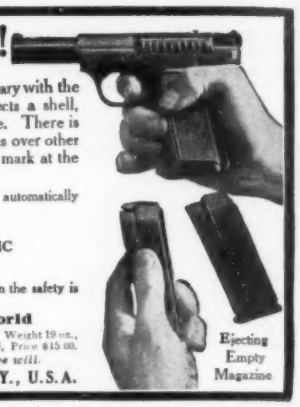
insuring extreme accuracy, safety, and freedom from fouling. When the safety is on neither force nor folly can discharge the pistol.

Ten Shots, the Biggest Handful in the World

Write us today for description of this new and wonderful rapid-fire gun. Weight 19 oz., including magazine. Beautifully balanced, shapely. Length 6½ in. over all. Price $15.00.

If your dealer cannot supply you, write us direct and we will.

SAVAGE ARMS CO., 842 Savage Ave., UTICA, N. Y., U.S.A.



Ejecting Empty Magazine

Pioneer Perfect Frames

and Boat Parts are **The Standard** of Boat Construction. We do all the hard part for you. Every frame is **set up** by an expert boat builder, **trued** and **tested** before taking apart for shipment. All ribs are bent to **exact shape, fitted** and **beveled for planki g. Not a shaving need be taken off anywhere.** With every frame we furnish all necessary patterns, illustrations and instructions for building the completed boat. Every piece is numbered. **Anyone can reassemble them.**

We also **furnish** when desired **every part** and thing **necessary** to **complete the boat** ready for the water.

We will furnish frames and parts for any kind of modern boat. Our boats are in service in every civilized country. The U. S. Government is among our patrons.

Our frames and material to finish will save you **two-thirds the cost** of a similar completed boat. The saving on freight alone is very great.

Write for Free Catalog or send 25c for **104-page Boat Builders' Book**—300 illustrations. **Satisfaction Guaranteed or Money Refunded.**

PIONEER BOAT & PATTERN CO., Wharf 331, Bay City, Mich.

Safety Razors FREE

To quickly introduce the celebrated **Ideal Shaving and Complexion Soap** which beautifies, removes pimples, blotches and all facial eruptions, leaving skin soft & clear & to prove what we claim is true, we will send a box of soap together with the latest new improved Safety Razor outfit in a fine handsome case all complete for shaving. **ABSOLUTELY FREE** to any one answering this advertisement at once & enclose **10cts.** silver or stamps to help pay boxing, packing, mailing, etc. Address

THE AMERICAN SOAP WORKS, 95 Chambers St., N. Y. City

HANDY IN EVERY HOME

Everybody who sees this useful and pretty little novelty wants one of the **Excelsior Combination Tweezers and Magnifying Glass**

No toy, but a practically useful article that is indispensable in every household. A powerful magnifying glass enlarges the object the tweezers are to work on, rendering it easy to extract splinters or hairs. Nickel plated and highly polished. Also useful for mill workers, jewelers, botanists, physicians, etc.

By mail 15, 35 and 50c., 3 sizes

A. Kleinman, Sole Mfr., 250 8th Ave., N. Y.

How to Construct An Independent Interrupter

In SCIENTIFIC AMERICAN SUPPLEMENT, **1615**, A. Frederick Collins describes fully and clearly with the help of good drawings how an independent multiple interrupter may be constructed for a large induction coil.

This article should be read in connection with Mr. Collins' article in SCIENTIFIC AMERICAN SUPPLEMENT, **1605**, **"How to Construct a 100-Mile Wireless Telegraph Outfit."**

Each Supplement costs 10 cents; 20 cents for the two. Order from your newsdealer or from

MUNN & CO., 361 Broadway, New York

Go To Bermuda

Weekly from New York, forty-five hours by twin screw S. S. "Bermudian" (**5,500 TONS**).

Fortnightly to BERMUDA and NASSAU by S. S. "Trinidad." **$40** up. Bermuda and return.

For illustrated pamphlets, passage, etc., write A. E. OUTERBRIDGE & CO., Agts., Quebec S. S. Co., Ltd., 29 Broadway, N. Y. Arthur Ahern, Sec'y, Quebec, Can., or Thos. Cook & Son and their Agencies.

Lincoln's Springfield

There he lived and there his body lies entombed. Besides the interest which attaches to a visit to the grave, the Illinois State Capital contains Lincoln's old home and many other places of deep interest to visitors. If your ticket reads over the

Chicago & Alton Railroad

between Chicago and St. Louis, stop-over at Springfield can be arranged without additional charge. The time-tables are arranged so that passengers can spend a few hours in sight-seeing en route between Chicago, St. Louis and Kansas City. Take advantage of the above suggestion offered exclusively by **"The Only Way"**

Send for circular of information.

GEO. J. CHARLTON, General Passenger Agent, Chicago.

Build Your Own Incubators and Brooders

Save money. Thousands are doing it every year. I teach you how and supply all the parts you cannot make, at low prices. My New Lampless Brooder will cost you $4.00. Greatest Brooder invention of the age. Repairs and supplies for all kinds of Incubators or Brooders. My new book of plans and catalogue has over 100 illustrations, showing step by step every stage of construction—so simple a 12 year old boy can follow them. Send 25c coin or U. S. stamps to cover cost. **Your money back if you are not satisfied. I allow the price of the book on your first order.** Send for the book today. Itmeans Dollars to you. H. M. SHEER, 512 Hampshire St., Quincy, Ill

TYPEWRITERS ALL MAKES

Visible Writers or otherwise **Olivers, Remingtons, Smiths, etc.** Shipped ANYWHERE for Free Trial, or RENTED, allowing RENT to APPLY.

Prices $15.00 Up

First class Machines *fresh from the Manufacturers*

Write for Illustrated Catalog 10. *Your opportunity.*

TYPEWRITER EMPORIUM, (Est. 1892) 92 & 94 Lake St., Chicago

Army Auction Bargains

Tents	$1.90 up	Old Pistols	$.50 up
Shoes	1.25 "	Officers' Swords, new	1.75 "
ARMY SADDLES	3.00 "	Cavalry Sabres	1.50 "
" Bridles	1.00 "	UNIFORMS	1.75 "
" Leggins, pr.	.15 "	7 Shot Carbine	3.50 "

U. S. SPRINGFIELD B-L RIFLES $1.79

With Blank or Ball Cartridge, 25 cents box of 20.

1907 MILITARY CATALOGUE, 260 large pages, thousands of beautiful illustrations—with 1908 supplement, wholesale and retail prices. Mailed for 15 cents (stamps). 15 ACRES GOVT. AUCTION GOODS

FRANCIS BANNERMAN, 501 Broadway, NEW YORK

Harper's Electricity Book for Boys

By JOSEPH H. ADAMS

WITH the help of this book any intelligent boy of an inquiring mind will find a new world of profit and amusement opened to him in making electrical devices and learning about the uses of electricity.

Beginning with simple explanations about electricity, the book shows how a boy may apply these principles in real practice at home, with few tools and little expense. Simple batteries, push-buttons, switches, magnets, induction coils, bells, and annunciators are the things the lad is first taught how to construct. A dictionary of electrical terms is appended which will prove especially helpful. No better book on electricity could be put into the hands of a boy.

With Many Illustrations and Diagrams. Crown 8vo. Cloth, $1.75

Harper's How to Understand Electrical Work

By WILLIAM H. ONKEN, Jr., and JOSEPH B. BAKER

WE know that trolley cars are impelled by an electric wire, we recognize the third rail of electric trains when we see it spitting flame in snowy weather. The question that every bright boy and girl naturally asks is, "How is it done?" The object of this book is to tell this story. The book differs from many "descriptions" of electrical appliances because it is written by practical men, and because there is no popular book on the subject so thorough and complete.

Fully Illustrated from Photographs, Drawings, and Diagrams. Crown 8vo. Cloth, $1.75

HARPER & BROTHERS, FRANKLIN SQUARE, NEW YORK

PROJECTION IN
Natural Colors

The Reflecting Lantern for showing on the screen illustrations, engravings, post cards and natural specimens, brilliantly illuminated in natural colors. Made in two styles.

The College Projector, a large powerful instrument. In use at Harvard, Cornell, University of Pennsylvania, Leland-Stanford and U. S. Government.

The Post Card Projector, on the same order but inexpensive, for showing post cards and other illustrations.

Send for list of Projectors, Stereopticons, Moving Picture Machines and Films.

WILLIAMS, BROWN & EARLE,
DEPT. 6, 918 CHESTNUT ST.,
PHILADELPHIA, PA

Notice to Contractors.

SEALED PROPOSALS for dormitory at Inwood, construction including heating, plumbing and electric work, at St. Lawrence State Hospital, Ogdensburg, N. Y., will be received by the State Commission in Lunacy at the Capitol, Albany, N. Y., up to 3 o'clock P. M., on February 24, 1909, when they will be opened and read publicly. Proposals should be accompanied by a certified check in the sum of $750, and the contractor to whom the award is made will be required to furnish surety company's bond in the sum of $6,500. The right is reserved to reject any and all bids. Drawings and specifications may be consulted and blank forms of proposal obtained at the St. Lawrence State Hospital, Ogdensburg, N. Y., and at the office of the State Architect. Complete sets of plans and specifications will be furnished to prospective bidders upon reasonable notice to and in the discretion of the State Architect, Franklin B. Ware, Albany, N. Y.

T. E. McGARR, Secretary, State Commission in Lunacy.
Dated Albany, N. Y., February 1, 1909.

WANTED.—LABORATORIANS. Pay from $3.04 to $4.00 per diem. A competitive examination will be held simultaneously at the Navy Yards, Boston, Mass., Brooklyn, N. Y., Philadelphia, Pa., and Washington, D. C., March 24, 1909, for the purpose of establishing an eligible register of laboratorians. Applicants should make application to the Commandant of the Yard at which they desire to be examined.

LET US BE YOUR FACTORY
STAMPINGS, MODELS, EXPERT WORK
THE GLOBE MACHINE AND STAMPING CO.
970 Hamilton St., Cleveland, O.

ICE MACHINES Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton St., Milwaukee, Wis.

MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery.
E. V. BAILLARD, 24 Frankfort Street, New York.

RUBBER Expert Manufacturers Fine Jobbing Work
PARKER, STEARNS & CO., 228-229 South Street, New York

HOEFT & COMPANY
Die Makers, Model Makers, Machinery Builders, Punch Presses, Light and Heavy Stampings. 159 Michigan St., Chicago, Ill., U.S.A.

MODELS CHICAGO MODEL WORKS
179 E. MADISON ST. CHICAGO, ILL.
ESTABLISHED 1887

Experimental & Model Work
Cir. & advice free. Wm. Gardam & Son, 221 Fulton St., N.Y.

DIE MODELS SPECIAL
WORK TOOLS MACHINERY
NATIONAL STAMPING AND ELECTRIC WORKS
153-159 S. Jefferson Street, Chicago, Ill.

MOORE & CO. Special Machinery, Dies, Tools, Models, Metal Specialties, Inventions perfected. Indiana and Franklin Streets, Chicago, U. S. A.

DRYING MACHINES For Steamed Rice Paddy and many other granular materials.
S. E. WORRELL, Hannibal, Mo., U. S. A.

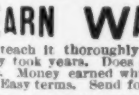
THE SCHWERDTLE STAMP CO.
STEEL STAMPS, LETTERS & FIGURES
BRIDGEPORT CONN.

Magical Apparatus.
Grand Book Catalogue. Over 700 engravings
25c. Parlor Tricks Catalogue, free.
MARTINKA & CO., Mfrs., 493 Sixth Ave., New York

MASON'S NEW PAT. WHIP HOISTS
save expense and liability incident to Elevators.
Adopted by principal storehouses in New York & Boston
Manfd. by VOLNEY W. MASON & CO., Inc.
Providence, R. I., U. S. A.

Telegraphy Circular free. Wonderful automatic teacher. 3 styles $2 up. OMNIGRAPH CO., Dept. 52, 39 Cortlandt St., New York.

Mated pair kissing.— From eggs to squabs in 4 weeks.



Write to-day for our 1909 **FREE Squab Book,** How to make money breeding Squabs
PLYMOUTH ROCK SQUAB CO, 361 Howard St, Melrose, Mass

LEARN WATCHMAKING
We teach it thoroughly in as many months as it formerly took years. Does away with tedious apprenticeship. Money earned while studying. Positions secured. Easy terms. Send for catalog.
ST. LOUIS WATCHMAKING SCHOOL, St. Louis, Mo.

ELECTRIC LAUNCH MOTOR.—THE design in this paper is for a motor of unusual simplicity of construction, which can easily be built by an amateur at small cost. It is intended for a boat of about 24 feet over all and 4 feet 6 inches beam, drawing 18 inches, and is capable of propelling such craft at a speed of 7 miles per hour. Illustrated with 21 cuts. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 1202. Price 10 cents by mail, from this office and from all newsdealers.

The INVENTOR'S UNIVERSAL EDUCATOR
TELLS ALL ABOUT PATENTS, HOW TO SECURE THEM. HAS
600 MECHANICAL MOVEMENTS
also 50 PERPETUAL MOTIONS
Every inventor should have a copy. Price $1.00 by mail.
F. Dietrich Ouray Bldg. Washington, D. C.

Canned peas and corn, Waukesha Canning Co.	72,693
Canned peas, beans, and corn, Waukesha Canning Co.	72,694
Canned peas, corn, and tomatoes, Waukesha Canning Co.	72,695
Canned prepared food, composed of beef, corn, and Spanish spices, Spanish-American Food Co.	72,691
Canned salmon, Alaska Packers Association.	72,680
Chain, sheet metal, Bridgeport Chain Co.	72,613
Cheese, imported camembert, Phenix Cheese Co.	72,669
Cigars, H. Fendrich	72,615
Cigars, G. P. Madden	72,618
Cigars, L. M. Crump	72,698
Cigars and scrap tobacco, C. C. Rodenbeck	72,623
Cigars, cigarettes, and tobacco, Calixtou Lopez & Co.	72,614
Clocks, electric, Kutnow Bros.	72,687
Clothing, certain, Tootle Campbell Dry Goods Co.	72,640
Cotton piece goods, Tootle Campbell Dry Goods Co.	72,641
Enameled metal ware, Strong-Battelle Manufacturing Co.	72,625
Flour, corn, B. Martinez	72,688
Flour, wheat, A. B. McCrillis & Son	72,676
Glass, New York Structural Glass Co.	72,661
Gum, pepsin chewing, Walla Walla Gum Co.	72,692
Hair pins, hooks and eyes, and nursery pins, William E. Cole & Co.	72,643
Handkerchiefs, E. E. Poor	72,697
Hats and caps, M. H. Witz	72,644, 72,645
Hose made of a combination of rubber and fabric, garden, Hibbard, Spencer, Bartlett & Co.	72,684
Hose, Peerless Rubber Manufacturing Co.	72,665
Hose, rubber, Peerless Rubber Manufacturing Co.	72,663, 72,664, 72,666, 72,667
Hydrocarbon containing sulfur, preparations of, Ichthyol Gesellschaft Cordes, Hermanni & Co.	72,605
Hydrogen peroxid, Middletown Chemical Co.	72,607
Inks, printers', Canadian Bronze Powder Works, R. E. Thorne & Co.	72,600
Insecticides, A. C. Meyer	72,606
Insulated electrical conductors, Acme Wire Co.	72,677 to 72,679
Iron and steel sheeting, galvanized, Monmouthshire Steel and Tin Plate Co.	72,619
Lamps, incandescent electric, Iron City Engineering Co.	72,685
Linen piece goods, Old Bleach Linen Co.	72,621
Magazine, Housekeeper Corporation	72,653
Matches, J. A. Hunt	72,654
Medicinal dietetical iron preparations, Dr. Degen & Kuth	72,602
Medicine for syphilis, etc., Vial	72,610
Milk, sterilized evaporated, Federal Packing Co.	72,682
Naphtha, Sun Co.	72,630
Newspaper, Press Publishing Co.	72,670
Newspaper, daily, Press Publishing Co.	72,671
Oil, nut, Naamlooze Vennootschap Nederlandsche Naamlooze Vennootschap Fransch-Hollandsche Oliefabrieken; Nouveaux Etablissements Calve-Delft	72,659
Oils, lubricating, Sun Co., 72,626 to 72,628, 72,631 to 72,637,	72,672
Oils, substitutes for linseed and cotton seed, Sun Co.	72,629
Overalls, jackets, and working shirts, J. Gross	72,616
Packing, machinery, Peerless Rubber Manufacturing Co.	72,689
Paper bags, Wayne Paper Mills	72,696
Paper testing machines, B. F. Perkins & Son	72,681
Piano mechanism, player, Regal Piano and Player Co.	72,622
Pianos, organs, and automatic piano players, A. B. Chase Co.	72,612
Pipes, Reiss Bros. & Co.	72,690
Plasters, corn, J. Ruzicka	72,609
Powder, explosive, Laflin & Rand Powder Co.	72,657
Powder, smokeless, Laflin & Rand Powder Co.	72,658
Radiators, American Radiator Co.	72,648
Rubber preparations for hygeian purposes, Dr. Degen & Kuth	72,603
Rubber roofing, prepared, G. E. Cory	72,650
Salve for animals, healing, Bickmore Gall Cure Co.	72,599
Salve, healing, W. A. Paxton	72,608
Sewing machines and attachments, Domestic Sewing Machine Co.	72,651
Shoes, leather, rubber, and canvas, National Shoemakers	72,620
Silk, rough surfaced broad, Rogers & Thompson	72,624
Sink strainers, F. H. & E. B. Vrooman	72,642
Suspenders, neckties, and neckscarfs, Tootle Campbell Dry Goods Co.	72,639
Syrups, certain, National Manufacturing Co.	72,660
Toilet preparations, certain, P. A. Houghton	72,605
Tonic beverage and syrup therefor, carbonated, Parker-Browne Co.	72,662
Turpentine and substitute therefor, spirits of, Sun Co.	72,673 to 72,675
Unions and valves, Illinois Malleable Iron Co.	72,655
Wall finishes, enamels, and varnishes, flat, Keystone Varnish Co.	72,686
Whisky, straight malt, Ginter Grocery Co.	72,652
Whisky, straight rye, Bonnie Bros.	72,649

LABELS.

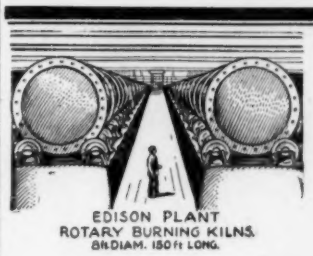
"Bokert Water," for natural mineral spring water, Bokert Springs Mineral Water Co.	14,628
"Bonita Upper Leather," for upper leather, William E. Moseer Co.	14,641
"Bruguier's Antiseptic Tooth Powder," for tooth powder, O. B. Bruguier	14,635
"Corset Francais de Bon Ton," for corsets, Royal Worcester Corset Co.	14,640
"Dicks Blue Diamond Kalsomine," for calcimine, J. F. O'Brien	14,636
"Dry Rog," for oranges, F. W. Young	14,630
"First Treasurer," for cigars, El Orfhenal Cigar Co.	14,624
"German-American Herb Compound," for a proprietary medicine, C. F. Myers	14,634
"Highgrove Brand," for oranges, Sugar Loaf Orange Growers Association	14,629
"Kawowka," for a cordial containing coffee, W. A. Sanoics	14,627
"Magnolia," for sliced beef, C. E. Nessle Packing Co.	14,633
"Malty," for a non-intoxicating malt beverage, Galveston Brewing Co.	14,626
"Mayflower," for sliced beef, C. E. Nessle Packing Co.	14,631
"Porter Weather-Proof Screens," for screens, Porter Screen Manufacturing Co.	14,643
"Progress Stogies," for stogies, W. Pollak, Sr.	14,625
"Savers," for cotton gloves, Kendallville Manufacturing Co.	14,639
"The 'Babesfoy' Nursing Outfit," for nursing outfits, Seamless Rubber Co.	14,637, 14,638
"Vernon's Special Flat Opening Blank Books," for blank books, S. E. & M. Vernon	14,642
"Waldorf," for sliced beef, C. E. Nessle Packing Co.	14,632

PRINTS.

"My Favorites," for chocolates with nut centers, Huyler's	2,416

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.



"Roasted to a Turn"
perfectly describes the perfection reached in fusing the perfectly burned "clinker" in the process of making

EDISON Portland Cement

Rotary kilns, 8 feet diameter and 150 feet long—longest in the world—burn the pulverized rock uniformly and perfectly. Then specially designed Edison machinery powders the "clinker" into the cement that is

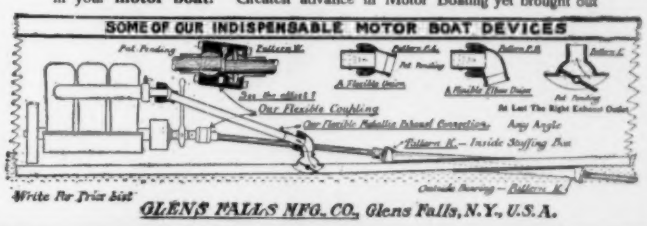
Uniformly 10% Finest Ground in the World.

Write us for catalog showing who specifies Edison Portland Cement, and where used.

GENERAL SALES OFFICE:
932 ST. JAMES BUILDING, NEW YORK

The New Method of Motor Installation

never fails to give all the horse power and all the speed. Insures perfect alinement of shaft, perfect exhaust. Saves time and money and insures more pleasure in your **motor boat.** Greatest advance in Motor Boating yet brought out



"CASTELL"
DRAWING PENCILS. Made in 16 degrees, 6B to 8H
THE FINEST IN EXISTENCE
Sold by all stationers and dealers in artists' materials. Sample sent to all parties interested on receipt of 10c. in postage stamps
A. W. FABER, 49 Dickerson Street, Newark, N. J.

SMALL HOUSE NUMBER of AMERICAN HOMES AND GARDENS

THE artistic and inexpensive house is the chief demand of the home seeker of to-day. For that reason the April, 1909, number of American Homes and Gardens will be a **SPECIAL SMALL HOUSE NUMBER.**

This issue will contain a vast amount of valuable information for the prospective home builder. It will tell him how to select a country site, how the various rooms of the house should be planned; the style of architecture in which the house should be designed; the material of which it may be built; the kind of plumbing fixtures to be used; the heating system to be selected; the choice of the hangings for the walls, doors and windows; appropriate furniture for the home; the interior decoration of the home; and the laying out of the grounds surrounding the house, as well as the planting of them.

THE ARTISTIC EXPRESSION OF THE SMALL HOUSE is well explained in an article by Francis Durando Nichols, illustrated with fifty engravings showing exterior and interior views and floor plans of a group of model houses of small size and small cost.

PLUMBING FOR A SMALL COUNTRY HOUSE, by John A. Gade, is a very important subject. No part of a house needs greater attention than the laundry, kitchen and bath room. Hence the economic and convenient placing of the plumbing fixtures, the kind to use, and the cost of the same are matters of interest to all prospective home builders.

THE MAKING OF AN IRIS GARDEN, by Samuel Howe, is an illustrated article showing how a swamp or lowland can be developed and transformed into a beautiful iris garden.

DECORATIVE FEATURES IN THE SMALL HOME, by Alice M. Kellogg, presents in a brief way with ten illustrations artistic schemes of covering the floors and walls of the house, harmonious and appropriate hangings for the doors and windows, with numerous suggestions for the decorating of the various rooms of the house.

A GROUP OF MODEL MOTOR HOUSES FOR THE SMALL COUNTRY PLACE, by Ralph de Martin, forms two pages of illustrations and sets forth the best designs for a small motor house suitable for the accommodation of one motor car and with sufficient space for a work bench.

HOME-MADE NOVELTIES FOR THE COUNTRY HOUSE, by Mabel Tuke Priestman, treats of the conversion of unlikely things into useful articles, and the illustrations show the results.

THE EVOLUTION OF THE SMALL HOUSE PLAN, by Joy Wheeler Dow, is an important article by a well-known architect on the economic planning of a small house, costing from $2,500 to $8,000. The plan and the arrangement of the rooms is the first thought given to the house and is one in which the layman should be most interested.

A FORMAL GARDEN AND PERGOLA, DESIGNED BY AN AMATEUR, by Alexander R. Holliday, informs the reader how an amateur planned and laid out his garden and how he built his pergola. Illustrated with plans and scale drawings.

PROPER FURNITURE FOR THE SMALL HOUSE, by Esther Singleton, with illustrations showing the artistic and appropriate furniture for the house, and the proper position in which it is to be placed, together with an accurate treatment of the fireplace and mantel.

THE USE OF CONCRETE IN THE BUILDING OF A SMALL COUNTRY HOUSE, by Benjamin Howes, is a timely and comparatively new subject, and is one in which much interest is shown at the present moment. The article is profusely illustrated with fifty engravings showing exterior and interior views and floor plans of small houses of various styles of architecture in which concrete is used with artistic results.

THE HEATING APPARATUS FOR THE SMALL COUNTRY HOUSE, by Allyn Frogner, is the title of an article treating in a practical manner one of the most important features of a small country house. How to heat and what is the cost? That is a question which has been well answered for the three respective systems of hot air, steam heat and hot water.

PROBLEMS IN PLANNING THE GROUNDS OF A SMALL COUNTRY PLACE, by Charles D. Lay. Mr. Lay has explained in a very concise form how the grounds around a small country place may be planted at a very low cost, and enumerates the best and most effective shrubs and plants to be used.

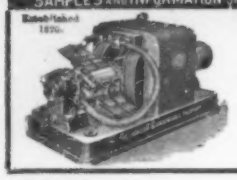
This **SMALL HOUSE NUMBER** will contain 165 illustrations covering 52 pages, which will be inclosed in a striking colored cover.

The price will be fifty cents. Those now subscribing for American Homes and Gardens for the year will receive it at the regular rate. Subscription price $3.00 a year.

MUNN & COMPANY, Publishers, 361 Broadway, New York City

DON'T BUY GASOLINE ENGINES UNTIL YOU INVESTIGATE "THE MASTER WORKMAN," a two-cylinder gasoline, kerosene or alcohol engine, superior to any one-cylinder engine; revolutionizing power. Its weight and bulk are half that of single cylinder engines, with greater durability. Costs Less to Buy—Less to Run. Quickly, easily started. Vibration practically overcome. Cheaply mounted on any wagon. It is a combination portable, stationary or traction engine. SEND FOR CATALOGUE. THE TEMPLE PUMP CO., Mfrs., Meagher and 15th Sts., Chicago. THIS IS OUR FIFTY-SIXTH YEAR.

COLD GALVANIZING.
AMERICAN PROCESS. NO ROYALTIES.
SAMPLES AND INFORMATION ON APPLICATION.



NICKEL AND **Electro-Plating**
Apparatus and Material
THE
Hanson & VanWinkle Co.,
Newark, N. J.
28 & 30 S. Canal St. Chicago.

"I Hear You Perfectly NOW!"

Box 44, West Nyack, N. Y.
Dec. 20, 1908.

General Acoustic Co.

Gentlemen:—I have been deaf for 40 years. During my service in the Civil War my ears became seriously affected from gun firing and have been growing steadily worse (if possible) ever since.

I want to thank you most sincerely for the opportunity to test the Acousticon; for I had lost faith in everything that claimed to make me hear. Though I could not hear conversation close to my ear, I can now hear it anywhere in the room clearly and distinctly. Some aids that I have tried help a little, but the Acousticon makes me hear just as clearly and at the same distance that I heard before I was afflicted at all.

I shall be very glad to have you use this letter in any way that you please. Gratefully,
THOS. R. HARRINGTON.

The experience of Mr. Harrington (whose photo appears herewith) is the same as that of thousands who are now using the Acousticon—to them we have said as we now say to you:

"Test the Acousticon, and let us prove that it will make you hear easily, distinctly and clearly."

ENTIRELY AT OUR EXPENSE."

If you are not convenient to one of our many offices you can test it at your own home, and if you do not hear satisfactorily the trial will not cost you one cent.

No trial fee, no penalty, no expense whatever if you do not hear.

A very light and unnoticeable headband makes it unnecessary to hold the earpiece, and leaves both hands perfectly free. Ladies who use the Acousticon dress their hair so as to make the headband and earpiece invisible.

The Acousticon is the original electrical hearing device, fully protected by U. S. patents, and you cannot secure anything as efficient under another name.

Write for particulars of the Free Test, booklets, etc., etc.

From $25.00 upward
(According to style)

THE GENERAL ACOUSTIC CO.
848 Browning Bldg., B'way & 32d St., New York

12,500 Bluejackets Coming Home

They're coming home in the big Fleet.

They left Hampton Roads on December 16, 1907, and have been away 14 months. During the cruise they have visited the ports in South America, the Pacific Coast of North America, Honolulu, New Zealand, Australia, Japan, China, the Philippines, Ceylon, Suez and the Mediterranean.

They've had a good time and a wonderful experience. Every one of these 12,500 bluejackets is far wiser and far bigger mentally than when he left home.

Such voyages are unusual in the U. S. Navy. The Navy Department doesn't want any boy to enlist in the hope of getting such a wonderful trip.

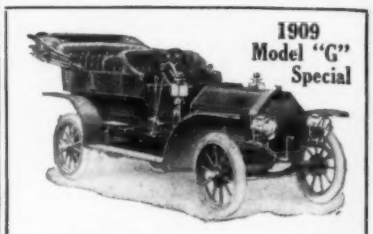
But the Navy Department wishes to point out that the bluejacket usually gets some travel, in home and foreign waters; always has the chance to make himself a bigger and broader man mentally and physically, and can learn almost any trade, provided he has some special aptitude.

If you are a young fellow who can't afford a college education, try four years in the U. S. Navy. Before doing so, if possible, ask some friend in the Navy whether or not you had better do it. One enlistment will be a life-long benefit to you, that is, if you make the most of all the opportunities.

Besides, you can save money in the Navy. Nearly all your expenses are paid.

If you have no friend in the service to inquire of, send for "The Making of a Man-o'-Warsman," an illustrated booklet which tells you everything you want to know about the Navy, in a simple and interesting manner. Address

BUREAU OF NAVIGATION, Box 39
Navy Department **Washington, D. C.**



1909 Model "G" Special

Glide *What You Get Not What You Pay—is the Basis of Automobile Values*

WHEN you feel wealthy or charitable, pay $4,000 or $5,000 for an automobile no better than the GLIDE.

When you approach the automobile buying problem as you would any other business investment, pay $2,250 for a GLIDE Roadster or $2,500 for a GLIDE Touring Car. The only difference in the two transactions will be, that you have a good car and a couple of extra thousand dollars in your pocket.

If it pleases you to make some automobile manufacturer a present of $2,500 or $3,000, do so, and change your mind next season. Every GLIDE agent knows that his strongest competition comes from cars which have the same features as the GLIDE Roadster and Touring Car, and which sell at from $2,000 to $5,000 more than any GLIDE Model.

The GLIDE is the first car perfect in size, in mechanism, and in action that has ever been offered to the public at a correct price.

Many years of automobile building are back of every GLIDE. Years of fruitful experience that have added to the merits and popularity of GLIDE Cars.

The power plant is a 4-cylinder (cast separately) 45 actual H.P. motor. The crank shaft has 5 bearings, not 2 or 3.

A constant level oiling system, eliminating piping and automatically maintaining the proper level of oil in the crank case at all times.

An improved form of selective type of transmission, located just forward of the rear axle, reducing the angularity of the propeller shaft.

A rear axle with liberally proportioned parts, and of a construction that gives an absolute assurance of perfect work.

A multiple disk clutch with disks of large diameter.

Double set of brakes—Internal expanding and external contracting. Brake drums are 16 inches in diameter, 3-inch face—will hold the car on a mountain grade. Absolute confidence in ability to slow down or halt at will is established when GLIDE brake equipment is examined. No brake system on any American or Foreign car has ever before been so comprehensively treated.

One Universal Joint only in GLIDE cars, located between the motor and the transmission. Remember, there are not two Joints or three Joints, or even four, as in other constructions.

Timken Roller Bearings throughout, all gears of the best Alloy Steel.

34 x 4½-in. tires all around—Wheel base 120 inches. Remember, tires are all alike, not 34 x 4-in. in front and 36 x 4½-in. in the rear, thus obviating the ridiculous necessity of carrying two sizes of spare casings and tubes.

The GLIDE is not an assembled car. It is built in our own shops, the motor excepted.

There is no more graceful car made. Its appearance suggests strength, reliability and that quiet purposeful performance which gives it the name—GLIDE.

If you are seeking a standard car of the best type, and at a price that is right, our catalogue, containing much detailed information, will be of considerable interest to you. Write today.

The Bartholomew Company
Standard Manufacturers A. M. C. M. A.
603 Glide St., Peoria, Ill.

Glide Roadster Model "R"—same chassis—wheel base 106 in.—36x4-in. tires all around, with either close coupled body seating four or Runabout body seating two—$2,250.

MODERN ELECTRICS

"That wonderful Electrical Magazine for Everybody." A splendid monthly for the experimenter and the amateur. The "How to Make It" magazine.

MODERN ELECTRICS during the first 6 months published more articles on Wireless than all the other electrical magazines combined. Are you surprised that it leads?

MODERN ELECTRICS has its own European correspondents and always gets the electrical news first, which others copy months later. The magazine is issued 12 times a year. Wireless Telegraph and Laboratory contests each month. Best photos get $5.00. The "Oracle" answers all your questions free. Wireless Department, etc., etc.

$1.00 a year in U. S., $1.25 Canada; $1.50 foreign. Sample copy 10 cents.

Modern Electrics Publication
84a West Broadway, New York City

WE SHIP ON APPROVAL *without a cent deposit*, prepay the freight and allow **10 DAYS FREE TRIAL.**

IT ONLY COSTS one cent to learn our *unheard of prices* and *marvelous offers* on highest grade 1909 model bicycles.

FACTORY PRICES *Do not buy* a bicycle or a pair of tires from *anyone* at *any price* until you write for our large **Art Catalog** and learn our *wonderful proposition* on first sample bicycle going to your town.

RIDER AGENTS everywhere are making big money exhibiting and selling our bicycles.

We Sell cheaper than any other factory.

Tires, Coaster-Brakes, single wheels, parts, repairs and sundries at *half usual prices.*

Do Not Wait; write *today* for our *special offer.*

MEAD CYCLE CO., Dept. L 175, CHICAGO

LEARN TO BE A WATCHMAKER

Bradley Polytechnic Institute
Horological Department
Peoria, Illinois
Formerly Parsons Horological Inst.
Largest and Best Watch School in America

We teach Watch Work, Jewelry, Engraving, Clock Work, Optics. Tuition reasonable. Board and rooms near school at moderate rates. Send for Catalog of Information.

CRUDE ASBESTOS
DIRECT FROM MINES

PREPARED ASBESTOS FIBRE for Manufacturers use

R. H. MARTIN,
OFFICE, ST. PAUL BUILDING
220 B'way, New York.

Cheap and Reliable Water Supply
For irrigation, mining, on the stock or dairy farm and for suburban homes the

NIAGARA HYDRAULIC RAM

is the cheapest pump you can install. No coal; no steam; no oil; no labor—no cost after installation. Works day and night. Write for catalogue A A and estimate. We furnish Caldwell Tanks and Towers.

NIAGARA HYDRAULIC ENGINE CO.,
140 Nassau St., N. Y. Factory: Chester, Pa.

WE WILL MAKE your models and give you estimates on manufacture of any metal novelty. Automatic machinery, tools, dies and expert work our specialty. AUTOMATIC HOOK & EYE CO., Hoboken, N. J.

Clean Kitchens are essential to good meals. You will find *both* on trains

—OF THE—

Chicago, Milwaukee & St. Paul Railway

The **PIONEER LIMITED** to St. Paul and Minneapolis
The **SOUTHWEST LIMITED** to Kansas City
The **OVERLAND LIMITED** to Omaha and California

Descriptive Folder Free

F. A. MILLER
General Passenger Agent
CHICAGO

G. A. BLAIR
General Eastern Agent
381 B'way, New York

THE WINDOWS THEY WANTED

It is with pride that we point to the fact that the owners of this fine building give us repeat orders for Mullins Fire-Proof Windows. Every window in this building is a "Mullins" and that means, protection, durability—and last but not least, a great saving in the cost of insurance.

American Bank Building, Seattle, Wash.
A. Warren Gould, Architect
Equipped with Mullins Fire-Proof Windows.

Mullins
Fire-Proof Storm-Proof Dust-Proof
Windows

make their own reputation wherever installed. Not only are they the most perfect windows made but they are the most effective fire-proof windows made. Entirely lock-seamed metal, no soldered joints in frame, sill or sash. Warping or buckling is impossible and heat contraction or expansion does not affect them in any way.

Mullins Fire-proof Windows are manufactured under supervision of Underwriters' Laboratories, Inc., according to the latest specifications of the National Board of Fire Underwriters and every window is inspected, approved and labeled with their official label. Send for descriptive catalog.

W. H. MULLINS COMPANY
203 Franklin Street, Salem, Ohio

WHY NOT BE AN ARTIST?

Our graduates are filling **High Salaried Positions.** Good artists **EARN $25 TO $100 PER WEEK** and upwards, in easy fascinating work. Our courses of **Personal Home Instruction** by correspondence, are **complete, practical.** Eleven years' successful teaching. Expert instructors. **Positions guaranteed** competent workers. Write for **Handsome Art Book, Free.**

SCHOOL OF APPLIED ART (Founded 1898.)
N 145 Gallery Fine Arts, Battle Creek, Mich.

$3.50 A Backus Water Motor

For Polishing, Grinding, and Power

Can be screwed on any faucet

BACKUS WATER MOTOR CO., Newark, N. J.

HELMET OIL **LUBRICATES ANYTHING** SEND FOR SAMPLE FREE
15-21 S. CLINTON ST.
C. H. BESLY & CO. CHICAGO, U.S.A.

Collier's

The National Weekly

COLLIER'S has made a place for itself with every one interested in the automobile. By pen and picture it has stimulated the industry and this is why among magazines Collier's has maintained a particularly strong position during the past six years, leading all mediums every year excepting one. (See table below.)

COLLIER'S is worthy of the minute study of every automobile advertiser who seeks a broad, national market. It invites inquiry and the opportunity to submit more facts which can not fail to be interesting.

The readers of Collier's pay over $2,500,000 a year in subscriptions. This is the largest subscription income obtained by any publication. Our readers can and do afford the best.

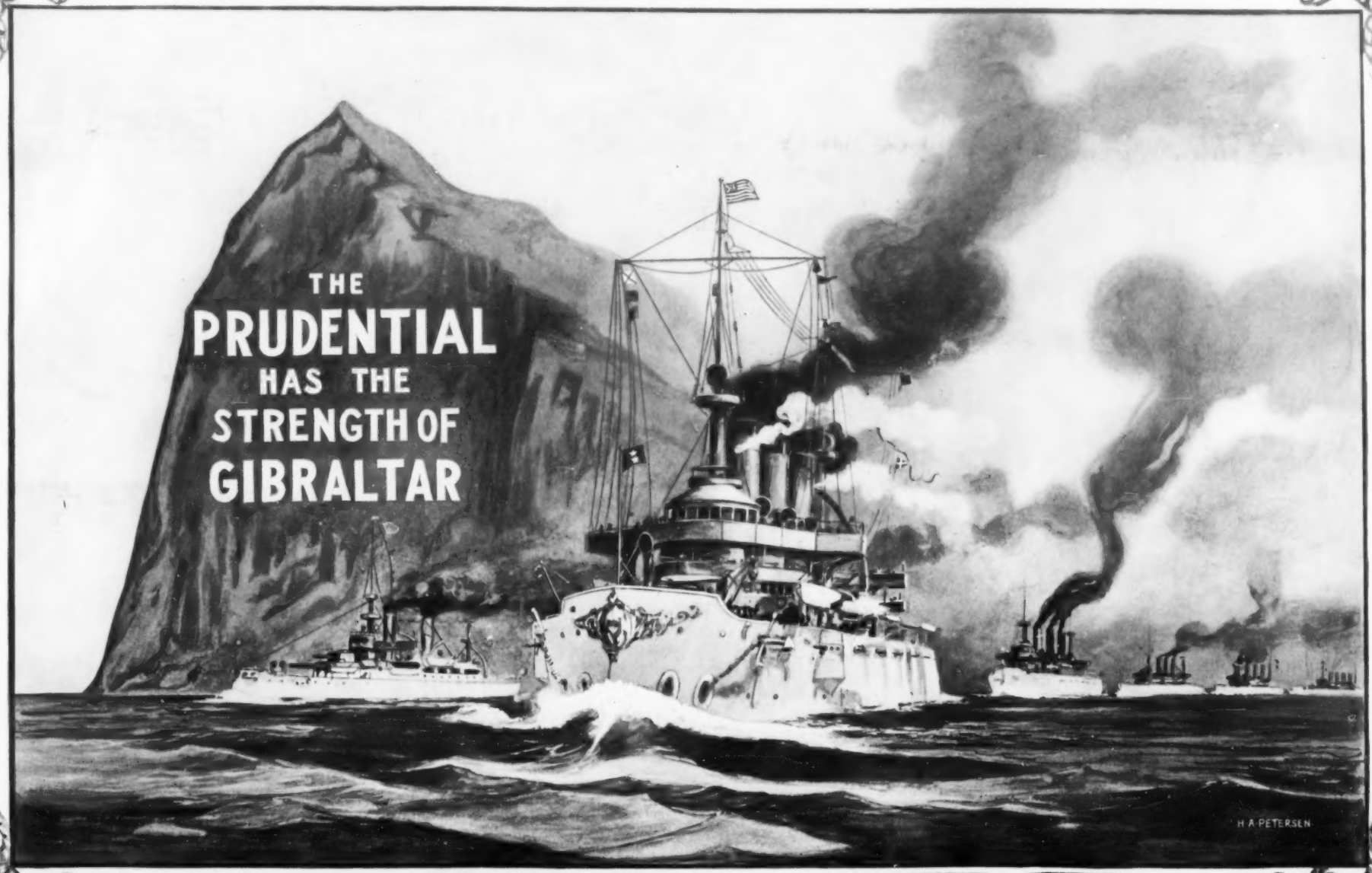
Where Automobile Manufacturers Place Their Advertising

The figures show the total number of agate lines of automobile advertising published by the five leading mediums during the past six years.

1903	Lines	1904	Lines
Collier's	30,585	Collier's	32,503
S. E. Post	23,585	S. E. Post	29,030
McClure's	20,136	McClure's	26,244
Harper's	18,098	Harper's	22,396
Scribner's	16,453	Life	20,350
1905		**1906**	
Life	45,378	Collier's	45,956
Collier's	45,239	Life	38,691
McClure's	33,480	McClure's	36,116
S. E. Post	31,548	Everybody's	27,188
Harper's	29,568	Century	26,614
1907		**1908**	
Collier's	50,591	Collier's	36,511
Life	43,908	S. E. Post	32,027
Country Life	29,172	Life	31,054
McClure's	27,566	McClure's	18,161
Scientific American	25,133	Everybody's	17,753

These figures, covering a period of six years, are an indication of how the Automobile industry ranks the leading advertising mediums.

E. C. PATTERSON
Advertising Manager
NEW YORK BOSTON CHICAGO



The FLEET PROTECTS *the* NATION — PRUDENTIAL LIFE INSURANCE PROTECTS *the* HOME

Copyright, 1909, by The Prudential Insurance Company of America.

A copy of this inspiring picture in colors will be sent free if you will write, requesting it, to Dept. 121, The Prudential Insurance Company of America. John F. Dryden, President. Home Office, Newark, N. J.

Incorporated as a Stock Company by the State of New Jersey.